

3. AFFECTED ENVIRONMENT AND POTENTIAL EFFECTS

The existing environment affected by the proposed actions and the potential environmental consequences of each alternative action are described in this chapter.

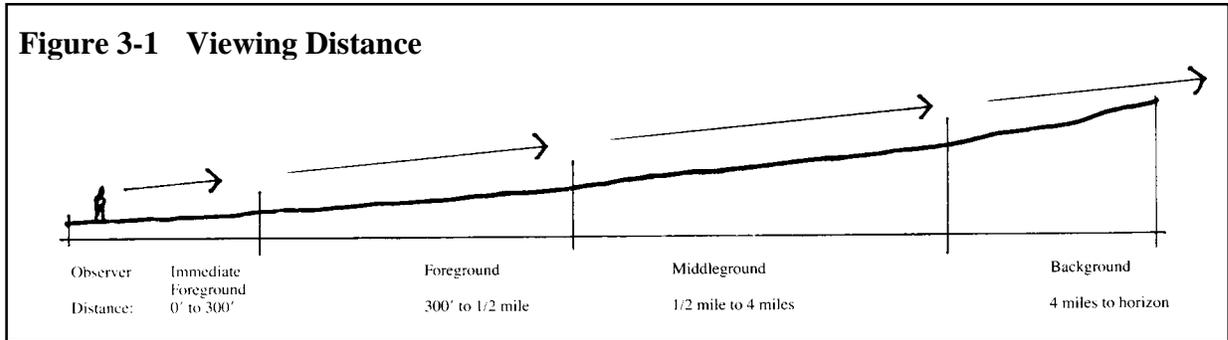
3.1 Visual Resources

Asked what they valued most about the land and water around Norris Reservoir, scoping respondents' most frequent response (24 percent) was the natural beauty and scenery. The physical, biological, and cultural features seen in the landscape give reservoir land its distinctive visual character and sense of place. Varied combinations of these elements make the scenic resources of any portion identifiable and unique. Areas with the greatest scenic value, such as islands, bluffs, wetlands, or steep forested ridges generally have the least capacity to absorb visual change without substantial devaluation. In the planning process, comparative scenic values of reservoir land were assessed to help identify areas for scenic conservation and protection.

Four broad visual characteristics were evaluated. Two of these distinct but interrelated characteristics—viewing distance and human sensitivity—are commonly considered together as scenic visibility:

- **Scenic attractiveness** is the measure of outstanding or unique natural features, scenic variety, seasonal change, and strategic location.
- **Scenic Integrity** is the measure of human modification and disturbance of the natural landscape.
- **Viewing distance** indicates scenic importance based on how far an area can be seen by observers and the degree of visible detail
 - * The **foreground distance** is within one-half mile of the observer, where details of objects are easily distinguished. Details are most significant in the immediate foreground of 0 to 500 feet.
 - * **Middleground** is normally between a half-mile and four miles from the observer, where objects may be distinguishable but their details are weak and tend to merge into larger patterns.
 - * **In the background**, landscape is beyond four miles, object details and colors are seldom discernible unless they are especially large, standing alone, or provide strong contrast. Figure 3-1 illustrates the viewing distance parameters.

Human sensitivity is the expressed concern of people for the scenic value of the land under study. Concerns are derived or confirmed by public meetings and surveys. Sensitivity also includes considerations, such as the number of viewers, frequency, and duration of views.



As an example, an area with high rock bluffs, interesting vegetative patterns, and little human alteration, which is seen frequently in the foreground for an extended time by medium numbers of people, such as residents or boat traffic, would have excellent scenic value. In contrast, an area with little scenic variety and a great deal of disruptive human alteration that is seen briefly in passing by a large number of people, such as motorists, would have poor scenic value.

Where and how a landscape is viewed affects human perceptions of the aesthetic quality and sense of place. These impressions of the visual character can have a significant influence on how scenic resources are appreciated, protected, and used.

3.1.1 Affected Environment

The visual landscape surrounding Norris Reservoir has a predominantly natural, undisturbed appearance. Extensive tree-covered ridges frame the occasional fields, rolling pastureland, and shoreline development. There are no actual towns or industrial facilities visible from the reservoir. The attractive natural features, together with the residential areas and other cultural development provide a scenic, relatively harmonious rural countryside.

Among the scenic resources of Norris Reservoir, the water body itself is the most distinct and outstanding aesthetic feature. The horizontal surface provides visual balance and contrast to the islands, bluffs, and wooded hillsides. The reservoir provides harmony and creates mystery as it weaves around the ridges and bends, constantly changing views seen from the water. It also provides unity, serving as a visual ribbon that links the other landscape features together. Middle ground views across the water provide a tranquil sense of place that is satisfying and peaceful to most observers.

Islands are another significant visual feature. They provide scenic accents and attractive visual reference points throughout the reservoir. They also serve as visual buffers for less desirable views of development, and provide a pleasing foreground frame for the distant shoreline or background. Some islands such as Island F show evidence of overuse which reduces scenic value and integrity. This includes an absence of understory vegetation, litter accumulation, and shoreline erosion.

The natural rock bluffs such as along the upper reaches of the Clinch River are also distinct scenic elements, along with similar sections of shoreline that exhibit unusual rock outcrops and formations. The rock faces rise sharply with steep, wooded ridges rising above them in

some locations. Associated with these bluffs are small wet weather waterfalls known as seeps, and displays of uncommon plants. The bluffs provide attractive vertical accents and a natural contrast of colors that can be seen from the middle ground. In upper reservoir sections they form a gorge-like visual character along both the Clinch and Powell Rivers.

Other important scenic features include the tranquil secluded coves and steep, wooded ridges that occur around the reservoir. The numerous coves with wooded shoreline provide peaceful, relatively private locations for fishing and overnight boat anchorage. They also provide an attractive setting or focal point for shoreline residents in some areas. Steep slopes along the shoreline rise mostly undisturbed to wooded skylines, with some ridge tops such as Lone Mountain reaching more than 900 feet above the water. The significant elevation changes provide a dramatic contrast to the surrounding lake and gently sloping countryside, particularly when they are viewed from background distances.

Three state parks and two wildlife management areas comprise large contiguous landholdings, which help preserve substantial stretches of undeveloped shoreline. Scenic values vary from excellent to very good and scenic integrity is high. Numerous residences ranging from cabins and second homes to large primary dwellings can be seen scattered around the shoreline, along with a variety of private water use facilities. The scenic value is moderately good, although scenic integrity is low. Concentrations of dwellings and related water use facilities are visually dominant on some parts of the reservoir, where they create a strong adverse contrast with the natural landscape character. Scenic value is fair and scenic integrity is very low.

The boat dock and marina developments provide access and anchorage for boats ranging in size from runabouts to large boats and floating cabins. These facilities adversely contrast with the undisturbed shoreline. Scenic values vary from fair to moderately good and scenic integrity is low. In addition, they support and contribute to the increasing variety, concentration, and visual congestion of recreational boating seen on the reservoir.

As a tributary reservoir, the water level of Norris has considerable fluctuation during the year due to power generation and flood control operations. The most scenic views of and from the reservoir are generally during the late spring and summer months when reservoir levels are highest. The normal drawdown of 42 feet or more exposes a “bath tub ring” of bare earth and rock around the shoreline from late summer to spring. This drawdown zone is a dominant visual element that provides strong adverse contrast with the surrounding landscape. Lake use is reduced from late fall to early spring, so the drawdown zone is most noticeable to residents and passing traffic on nearby roads. Although a negative visual impact is associated with the drawdown zone, it does expose additional rock formations and bluffs at various points on the reservoir. Sightings of deer, turkey, and other forms of wildlife are more frequent along the exposed shoreline. At different lake elevations, a variety of islands appear within the reservoir that may have some visual interest for boaters, highway travelers, and shoreline residents.

3.1.2 Environmental Consequences

Visual consequences are evaluated in terms of the visible differences between an existing landscape and proposed actions, based on the scenic values, viewing distances, and viewing points available to the general public. This helps identify potential adverse changes in scenic character based on commonly held perceptions of landscape beauty and the aesthetic sense of place.

The value of existing scenery has been confirmed by public input. Public comments, summarized in the survey report, Appendix A-2, indicate that TVA should place a high priority on preservation of natural areas, wetlands, and sensitive resource areas. Their comments identify concerns about shoreline erosion, loss of natural resources, and increased/unwanted development. Respondents specifically expressed preferences for the scenic beauty and concern about over-development. They indicated that scenic natural beauty was what they valued most--about equally with water quality. These responses indicate a public appreciation of visual aesthetics, along with a clear desire to encourage preservation of the area's natural resources and scenic attractiveness.

Most human alterations around Norris Reservoir have added visual discord to the natural landscape. Fortunately a significant amount of natural shoreline and scenic features remain undisturbed. Careful land management can help balance and hopefully dilute the visual discord by retaining sufficient undisturbed land to preserve the attractive scenic qualities of the reservoir. Practices such as scenic protection in strategic locations, visual impact reviews by project, and direction/mitigation of future development can help minimize further adverse visual impacts.

With either alternative, development standards implemented through TVA's SMP would limit the size of docks, which would help minimize increasing visual congestion on the reservoir. In addition, conservation easements are encouraged to protect resources and scenic values along the shoreline. When established, these easements would also help lessen cumulative visual impacts.

Alternative A—Under this alternative, the current Forecast System would remain in place. The Forecast System has no land use designation (see definitions in Table 2-2) or provisions for visual/aesthetic resource protection. Forecast System land uses would likely continue to be administered with about 20,000 acres of public land possibly being subject to various forms of development. Sections of highly attractive shoreline, as well as those of more common visual quality would continually be at risk for loss from development under the Forecast System. A slow but noticeable decline in scenic resources, aesthetic quality, and visual landscape character could be expected as residential, commercial, and industrial development demands continue to increase.

In evaluating section 26a and land use actions TVA would continue to consider the project's potential visual impacts prior to approval of the action. This process may prevent the most serious visual disruptions or loss of scenic resources. It may also require mitigation measures that reduce visual impacts.

Alternative A would probably result in relatively little preservation of specific scenic areas. A gradual loss of natural undisturbed areas may also continue, along with alteration of land having the least capacity to absorb visual change. The cumulative effects of Alternative A, which has over 18,000 acres designated as Public or Commercial Recreation, could reduce the scenic attractiveness of Norris Reservoir land over time, resulting in an adverse impact on the visual landscape character and aesthetic sense of place. The Steam Plant Study area (parcels 211, 212, 228 and part of 208 and 226) is also subject to development under this alternative.

Alternative B—Under this alternative, the visual/aesthetic resources of Norris Reservoir would be enhanced through preservation and protection. Scenic areas identified during the planning process would be specifically allocated to land use zones the Sensitive Resource Management and Natural Resource Conservation Zones. The proposed Norris Plan would provide protection for areas of greatest scenic value, and balance any further development with the preservation of sufficient undisturbed shoreline to retain the attractive natural character of the reservoir.

Over 4,800 acres of land with distinctive visual characteristics, such as islands, rock bluffs, steep wooded ridges, and wetlands would be would be allocated to Zone 3, Sensitive Resource Management. Almost 19,000 acres would be allocated to Zone 4, Natural Resource Conservation, which includes land with attractive but less unique scenic qualities and minor visible alteration. Most of the 18,000 acres designated as Developed Recreation in Alternative A would be allocated for zone 3 or 4. Activities that involve little visible change, such as recreational hiking, picnicking, bank fishing, and some selective forest management could take place under both categories of use. Selected development with more visible modifications could take place under the Zone 4 designation, as long as the location and appearance remained subordinate to the desired visual characteristics. A total of 23,775.8 acres (about 85.1 percent) of TVA public land would be allocated to these two zones. Management and protection of the scenic landscape character would provide direction for any land use decisions affecting these parcels. The environmental review process ensures that visual impacts would also be considered in decisions affecting the proposed use of parcels in other zones.

Alternative B would be responsive to the public's expressed concern for visual aesthetics. It would directly address stated preferences for more protection of scenic resources and natural undeveloped areas on reservoir land. Those using the reservoir would have assurance that the natural characteristics and beauty of selected bluffs, islands, coves, and reservoir shoreline were being retained and protected for public use and enjoyment.

Alternative B would have an increasingly beneficial impact on visual resources over time. The sensitive resource and conservation zones would provide protective management as demands for residential, commercial, and industrial development increase. Scenic values and visual integrity would remain moderately high or higher for land in these zones. With implementation of Alternative B, substantial preservation of the scenic qualities, aesthetic sense of place, and attractive visual character of Norris Reservoir could be expected. Alternative B would have beneficial impacts to the aesthetic resources of Norris Reservoir.

The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on visual resources.

3.2 Cultural Resources

3.2.1 Archeological Resources

Affected Environment

For at least 12,000 years the land along the Clinch and Powell Rivers have been an area for human occupation which became more intense through succeeding cultural periods. In the upper east Tennessee area, archaeological investigations have demonstrated that Tennessee and the eastern ridge and Valley regions were the setting for each one of these cultural/temporal traditions, from the Paleo-Indian (12,000-8,000 B.C.), the Archaic (8,000-1,200 B.C.), the Woodland (1,200 B.C.-1000 A.D.), the Mississippian (1000-1500 A.D.), to the Protohistoric-Contact Period (1500-1750 A.D.). Historic era cultural traditions have included the Cherokee (1700 A.D.-present) and European- and African-American (1750 A.D.-present) occupations.

Prior to the construction of Norris Dam, the University of Tennessee and crews supplied by the Civil Works Administration conducted a major archaeological survey of the Norris Basin in 1934 (Webb, 1938). This investigation focused on the prehistoric occupation of the area. Twenty-three sites were identified and excavated. A survey of the Norris Dam State Park was conducted by the Tennessee Division of Archaeology in 1984 (Froeschauer et al., 1986). In the mid-1990s some limited archaeological surveys associated with road construction were conducted by the University of Tennessee's Department of Transportation Center (DuVall, 1995; Greene, 1995; Juchniewicz, et al., 1994).

TVA is mandated under the National Historic Preservation Act (NHPA) of 1966 and the Archaeological Resources Protection Act (ARPA) of 1979 to protect significant archaeological resources and historic properties located on TVA publicland or affected by TVA undertakings. A historic property is defined, under 36 C.F.R. § 800.16 (l), as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).” In response to this federal legislation, TVA conducts inventories of its land to identify historic properties.

For the action proposed in this EA, the Area of Potential Effect (APE) is the 27,926. acres of retained TVA public land being planned or previously committed to specific land uses. The APE, as defined in 36 C.F.R. § 800.16(d), is

“the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist.”

TVA contracted with TRC Garrow and Associates (Pietak, et al., 1999) to conduct a Phase I cultural resources survey of approximately 3,214 acres (in 1999) and 231 miles of shoreline of TVA public land (in 1996) being planned and located above summer pool level on Norris

Reservoir. The parcels were surveyed based on the probability of future recreational or industrial/commercial development.

Existing data, along with the recent survey results, were reviewed and over 300 archaeological sites have been identified within and along Norris Reservoir. A number of these sites have been inundated due to reservoir impoundment. Prehistoric components and sites dating from the Archaic through Woodland Periods were recorded. Historic archaeological sites were associated with the nineteenth-twentieth century habitation of the area. There were 83 sites recommended as potentially eligible for inclusion on the NRHP, and 39 sites were recommended as ineligible for listing in the NRHP. In addition, one site will be further investigated to determine eligibility status. TRC Garrow and Associates completed a second survey of Norris Reservoir that involved parcels associated with the Norris Plan. This survey of 3,214 acres identified 128 sites and revisited two previously recorded sites. Prehistoric components and sites dating to possibly the transitional Paleo-Indian or Early Archaic through the Mississippian and Protohistoric Periods were identified. Historic archaeological sites potentially associated with the late eighteenth totwentieth century occupation of the area were identified. Through consultation with the State Historic Preservation Officer (SHPO), it was determined that 60 sites were potentially eligible for inclusion on the NRHP. In addition, one site will be further investigated to determine eligibility status. About 24,713 acres were not fully investigated during the preparation of this EA and recent surveys. These parcels were not fully investigated either because no development was anticipated, or there was a low probability of the presence of archaeological resources due to the steep terrain.

Environmental Consequences

Under either alternative, prior to an undertaking TVA would conduct the phased identification and evaluation procedure set forth in 36 C.F.R. § 800.4(b)(2), regulations of the Advisory Council on Historic Preservation, and would implement Section 106 of the NHPA in order to identify, evaluate, and assess effects on historic properties and to determine the appropriate course of action. An undertaking is defined, under 36 C.F.R. § 800.16(y) as,

“a project, activity or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license or approval; and those subject to state or local regulation administered pursuant to delegation or approval by a federal agency.”

As with all undertakings, TVA will take necessary steps to ensure compliance with regulatory requirements of the NHPA and ARPA. The results of archaeological testing on Norris Reservoir will be consulted prior to undertaking site-specific activities under either alternative. TVA will continue the present process of case-by-case review in TVA-controlled areas potentially subject to ground-disturbing actions, such as dredging, shoreline development, or timber harvesting through phased identification and evaluation of historic properties. Archaeological resources within these areas would be avoided and protected whenever possible. If avoidance is not possible, then proper procedures would be

implemented in the mitigation of the historic property. Under either alternative, the cumulative effects to significant archaeological resources will be minimized by avoidance and protection of the resource or by mitigation through data recovery excavations pursuant to 36 C.F.R. § 800.

Alternative A— A number of archaeological resources in the APE are considered potentially eligible for listing in the NRHP. Approximately 73 percent of the recorded archaeological resources are located on land allocated for public recreation. The remaining 27 percent are located in dam reservation, reservoir operations, and steam plant study areas. Under this alternative, site-specific activities proposed in the future would be approved, mitigated, or denied according to the significance of the resource. If mitigation is required, appropriate archaeological investigation would be necessary, and potentially impacted resources would be properly recorded and removed. The Forecast System does not provide for specific preservation of archaeological resources. However, these resources will be protected in the course of complying with regulatory requirements of the NHPA and ARPA.

Alternative B—This Alternative would incorporate the phased identification and evaluation procedure to effectively preserve historic properties. Early identification of the presence of cultural resources through zoning avoids the likelihood of soil-disturbing activities in areas known to contain historic properties. This would, in turn, save time, reduce costs, and ensure more efficient compliance with Section 106 of the NHPA than under Alternative A. All soil-disturbing activities that occur on parcels which contain historic properties would be reviewed by a TVA archaeologist. TVA will take necessary steps to ensure compliance with regulatory requirements of the NHPA and ARPA.

The investigations at Norris Reservoir identified archaeological resources within all five zones to which land was allocated (Table 3-1). Under Alternative B, 57 percent of archaeological resources would be placed in Zone 3 (Sensitive Resource Management) and Zone 4 (Natural Resource Conservation). Zones 3 and 4 would effectively preserve the resources. Further investigations would be required if the resources could not be avoided by future resource protection and management activities.

The remaining 43 percent of the archaeological resources in the APE would be in Zone 2 (Project Operations), Zone 6 (Recreation) and Zone 7 (Residential Access). Only 3,214 acres (11.5 percent) proposed plan land has been surveyed for archaeological resources. All activities proposed in Zones 2-7 would require further review under Section 106 of the NHPA. The greatest potential for development would be in Zone 7 and identification of archaeological resources within this zone would enable development to avoid the resources effectively. If the resources could not be avoided, then further investigations would be required to determine the resources' eligibility for inclusion in the NRHP. Within Alternative B, there is a commitment to management of archaeological resources within Zones 3 and 4 and effectively preserve resources within the other planned parcels. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on archeological resources.

Under Alternative B a Programmatic Agreement will be prepared and executed for identification, evaluation, and treatment of all historic properties in the APE that are eligible for inclusion in the NRHP. According to stipulations of the Memorandum of Agreement (MOA), NRHP eligibility will be evaluated in consultation with the SHPO. Furthermore, mitigation of adverse effects to any historic property will be conducted according to the stipulations in the MOA.

Zone	Number of Recorded Archaeological Sites	Percent of Total Sites within each Zone
2	3	1.2
3	95	38.6
4	46	18.7
6	24	9.8
7	78	31.7
Total	246	100.0

3.2.2 Historic Structures

Affected Environment

Structures and man-made features which are over 50 years old (including farmhouses, churches, and cemeteries and Norris Dam), on or adjacent to TVA parcels, are classified as historic by definition under NRHP criteria. All sites considered potentially eligible or eligible for listing on the NRHP have been identified and mapped. Most of these features—with the exception of Norris Dam—are not on TVA parcels, but are adjacent to or near TVA parcels. Many of the historic sites are along the access roadways leading to TVA public land.

Following is the list of proposed TVA parcels which have these adjacent historic structures and features, and in some instances historic features on the parcel.

- **Parcel 3:** Island Home Church and Miller Cemetery along Norris Freeway on interior of this parcel. Former Civilian Conservation Corps (CCC) Camp 4493-5 location adjacent on east side, now largely impacted by new subdivision development. NRHP listed Norris Historic District adjacent to southeast.
- **Parcel 6:** Early barn and mill moved on parcel during Norris Dam impoundment. Former CCC Camp 494 location adjacent on east side. Norris Dam, eligible for listing on the NRHP.
- **Parcel 12:** Former early 20th century frame school house with several classrooms. Early 20th century frame house. Both adjacent to the southwest and along road access to TVA Parcel.

- Parcels 34, 37, and 38: Coopers View Cemetery, on sold Hiwassee No. 2 Tract, adjacent to or in view-shed of these parcels. Not much protection as cemetery is being surrounded by residential development.
- Parcel 72: Murrayville Church Cemetery, church building has been replaced with new. Adjacent to northeast portion of parcel.
- Parcels 75 and 77: Sharp Cemetery, on ridge top within sold tract, adjacent to north of parcel 75 and west of parcel 77. Will probably be subject to visual impact by future residential development.
- Parcels 120 and 121: Nat Hollow Cemetery, within parcel 120, in view-shed of west edge parcel 121.
- Parcel 122: Historic Stiner's Woods, a unique surviving virgin wooded tract. Needs visual and development protection from all sides, including numerous TVA parcels.
- Parcel 145: Minton Mill Dam, on Gap Creek just upstream of north edge of parcel 145. Mill building is gone.
- Parcel 181: Graves Cemetery adjacent to parcel on north side of southwest portion of parcel. Cemetery on sold Shelley tract.
- Parcel 183: Historic farm complex adjacent to east edge parcel.
- Parcels 182, 185, and 274 through 276: Route 33 Bridge over the Clinch River, built for impoundment of Norris Lake.
- Parcel 194: Substantial log house adjacent to parcel north of large inlet downstream of Straight Creek.
- Parcel 209: Jackson Cemetery, heavily impacted by development and southern portion of parcel 209.
- Parcel 212: Evans Cemetery within this parcel.
- Parcel 217: Big Spring Union Church and Cemetery on Little Sycamore Creek upstream from parcel 217. Log church built 1795-96, listed on the NRHP.
- Parcel 250: Large historic frame house at Williams Springs and several smaller less significant houses along Dutch Valley Road which is the only access to this parcel.
- Parcels 252 through 255: Historic frame church on only access road to these parcels. Other historic farm houses along this road.
- Parcel 254: Arnwine Cemetery within this parcel.
- Parcel 257: Beeler Mill Dam on Williams Creek. A stone dam upstream from parcel 257. Mill structure gone.
- Parcels 259 and 260: Historic steel truss bridge over Hogskin Creek. Endangered by bridge replacement for increased development.

- Parcels 302 through 315: The only access roads to these locations as well as to the many sold tracts have historic houses along them which could be adversely impacted by increased traffic, road improvements, etc.
- Parcels 310, 311, and 312: Mt. Pleasant United Methodist Church and Cemetery. White frame 1888 church building on road providing access to these parcels as well as sold tracts Hagarman, Oak Ridge Yacht Club 2, Anderson County Sportsman's Club, Hammer, and Anderson County Park..

Environmental Consequences

All actions considered on a TVA parcel will require review and assessment for potential impacts on these historic structures. Impacts can be positive or adverse. Adverse impacts include visual changes of the environment surrounding these sites, noise, increased road traffic, increased development (changing the existing landscape), etc. Some sites are more sensitive to potential TVA actions. Proposed TVA actions affecting historic structures will require SHPO review, as mandated under Section 106 of the NHPA. Mitigation and/or modification of the TVA action may be requested to protect the historic resource from adverse impacts.

Alternative A—Under the No Action Alternative, site-specific activities proposed in the future would be approved, mitigated, or denied according to the significance of the historic structure. This would require a survey of the APE to determine what features exist on TVA public land or adjacent land.

Alternative B—Under this alternative, all uncommitted TVA public land with historic structures would be allocated to Zone 3 (Sensitive Resource Management) or Zone 4 (Natural Resources Conservation) for protection. Committed land in Zone 2 (TVA Project Operations), Zone 5 (Industrial/Commercial), Zone 6 (Recreation) and Zone 7 (Residential Access), has been surveyed, and all significant historic structures on and adjacent to these TVA parcels have been identified. Alternative B places more historic resources in land use categories that will provide cultural resource protection than Alternative A. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on historic structures. Under all alternatives, review for applicability of the NHPA would take place for any proposed activities that have the potential to affect historic resources identified on or adjacent to TVA public land. It should be recognized that the current status of any of the identified structures could change by actions taken by the owners or by acts of nature.

3.3 Threatened and Endangered Species

3.3.1 Affected Environment

3.3.1 - 1 Plant Species

Prior to the 1999 field surveys for the Norris Plan, a search of the TVA Natural Heritage Project database was conducted to identify protected plant species known from the six Tennessee counties (Anderson, Campbell, Claiborne, Grainger, Hancock, and Union) containing portions of Norris Reservoir. It should be noted that while there is no TVA public land in Hancock County, the county is in the Norris watershed and species occurring in that county could also be present on land considered as part of either alternative.

The results of the search indicated that no federally-listed and 29 Tennessee state-listed plant species (97 occurrences) were known from these counties (Table 3-2). This list, combined with regional information on additional species likely to occur on Norris Reservoir land, provided a focus for the field surveys. During the 1999 field inventories of 3,214 acres, areas which appeared to be suitable habitat for listed plants were intensively surveyed. Surveys continued until the botanist determined that additional searches for rare plants would be unproductive. Several parcels contained more than one listed plant species. No federally-listed plant species were found. Twelve Tennessee state-listed plant species (39 occurrences) were found during this survey. Table 3-2 provides a list of plant species presently known from the parcels being planned, the number of different parcels on which they were found, and their current status. A discussion of each of the 12 Tennessee state-listed species follows Table 3-2.

TABLE 3-2 LISTED PLANT SPECIES KNOWN TO OCCUR IN THE VICINITY OF NORRIS RESERVOIR AND SPECIES FOUND DURING PARCEL SURVEYS			
Common Name	Scientific Name	Found During Parcel Surveys	Tennessee State Status
Alder-leaf buckthorn	<i>Rhamnus alnifolia</i>		E
American barberry*	<i>Berberis canadensis</i>	Yes (1 Parcel)	SC
American ginseng	<i>Panax quinquefolius</i>	Yes (8 Parcels)	S-CE
Appalachian bugbane	<i>Cimicifuga rubifolia</i>	Yes (1 Parcel)	T
Branching whitlow-wort	<i>Draba ramosissima</i>		SC
Bush honeysuckle	<i>Diervilla lonicera</i>		T
Butternut	<i>Juglans cinerea</i>	Yes (1 Parcel)	T
Canada lily	<i>Lilium canadense</i>	Yes (2 Parcels)	T
Climbing fumatory	<i>Adlumia fungosa</i>		T
Cumberland rosin-weed	<i>Silphium brachiatum</i>		E
Goldenseal	<i>Hydrastis canadensis</i>	Yes (4 Parcels)	S-CE
Green-and-gold	<i>Chrysogonum virginianum</i>		T
Kentucky rosinweed*	<i>Silphium wasiotense</i>	Yes (2 Parcels)	E
Largeleaf grass-of-parnassus	<i>Parnassia grandifolia</i>		SC
Large roundleaf orchid	<i>Platanthera orbiculata</i>		T
Leatherleaf meadowrue	<i>Thalictrum coriaceum</i>		T

TABLE 3-2 LISTED PLANT SPECIES KNOWN TO OCCUR IN THE VICINITY OF NORRIS RESERVOIR AND SPECIES FOUND DURING PARCEL SURVEYS			
Common Name	Scientific Name	Found During Parcel Surveys	Tennessee State Status
Meehan's mint	<i>Meehania cordata</i>		T
Michigan lily	<i>Lilium michiganense</i>		T
Mountain honeysuckle*	<i>Lonicera dioica</i>	Yes (1 Parcel)	SC
Northern white cedar	<i>Thuja occidentalis</i>	Yes (2 Parcels)	SC
Ozark bunchflower*	<i>Melanthium woodii</i>	Yes (2 Parcels)	E
Pink lady's-slipper*	<i>Cypripedium acaule</i>	Yes (6 Parcels)	E-CE
Porter's reedgrass	<i>Calamagrostis porteri</i>		T
Red iris	<i>Iris fluva</i>		T
Roundleaf bittercress	<i>Cardamine rotundifolia</i>		T
Shining ladies' tresses	<i>Spiranthes lucida</i>		T
Showy lady's slipper	<i>Cypripedium reginae</i>		E
Southern rein orchid	<i>Platanthera flava var flava</i>		SC
Spike-rush	<i>Eleocharis intermedia</i>		SC
Spreading false-foxglove	<i>Aureolaria patula</i>	Yes (6 Parcels)	T
Spreading rockcress	<i>Arabis patens</i>		E
Tall larkspur	<i>Delphinium exaltatum</i>		E
Waterweed	<i>Elodea nuttallii</i>		SC
Witch-alder	<i>Fothergilla major</i>		T
<p><i>E: Endangered SC: Special Concern</i> <i>T: Threatened S-CE: Special Concern-Commercially Exploited</i> *Species that were not known to occur in the Norris vicinity, but were found during the parcel surveys. Note: No federally-listed plant species were known to occur in the Norris vicinity or found during parcel surveys. (Norris vicinity includes Anderson, Campbell, Claiborne, Grainger, Hancock, and Union counties)</p>			

American barberry (*Berberis canadensis*)—This member of the barberry family is typically found on rocky, wooded slopes; bluffs; creek banks; and roadsides. A single plant of American barberry occurs, along with two other state-listed plant species, in the rocky, wooded area of one parcel. Thirteen other populations of this species are presently known from the state of Tennessee.

American ginseng (*Panax quinquefolius*)—American ginseng favors shady, mesic sites, especially under American beech and sugar maple. This species is protected because it is frequently harvested from the wild for use in commercial herb trade. In addition, suitable habitat for this plant is becoming increasingly rare due to general habitat loss. This species occurs, usually as single individuals, on eight parcels. More than 160 other populations of this species are known from the state of Tennessee.

Appalachian bugbane (*Cimicifuga rubifolia*)—A member of the buttercup family, this species is typically found on rich, well-drained, loamy soils in a closed canopy of mixed hardwoods. This species is threatened by forest-clearing activities and erosion associated with logging. One individual of Appalachian bugbane occurs on one parcel. Fifty-four other populations of this species are known from the state of Tennessee.

Butternut (*Juglans cinerea*)—This member of the walnut family usually reaches a height of 30 to 60 feet and a diameter of 1 to 2 feet at maturity. Butternut prefers moist, rich soils but can also grow on drier, rocky sites. Although this tree is found in every physiographic province in Tennessee, forest stands rarely contain more than an occasional tree. Threats to this species includes a fungal disease and excessive shading. This species occurs on one parcel. Thirty-three other populations of this species are known from the state of Tennessee.

Canada lily (*Lilium canadense*)—This member of the lily family normally grows in moist, sunny areas with acidic soils. The population of approximately 50 plants occurs on one parcel with this typical habitat. However, on another parcel this species occurs on a very dry, rocky site. Forty-five other populations of this species are known from the state of Tennessee.

Goldenseal (*Hydrastis canadensis*)—This member of the buttercup family is typically found in rich soils in dry or moist forest types. Populations of this plant have been greatly reduced as a result of habitat destruction and over harvesting for the herb trade. Four parcels have one occurrence each of this Tennessee state-listed special concern (commercially exploited) plant. Eighty other populations of this species are known from the state of Tennessee.

Kentucky rosin-weed (*Silphium wasiotense*)—This member of the sunflower family is typically found in forests or forest edges. Two parcels have two occurrences each of this Tennessee state-listed endangered plant. Eight other populations of this species are known from the state of Tennessee.

Mountain honeysuckle (*Lonicera dioica*)—This sprawling shrub or vine grows on steep, rocky, shaded slopes. One nonflowering plant was found; therefore, positive identification was not possible. This potential population was found on one parcel. Eighteen other populations of this species are known from the state of Tennessee.

Northern white cedar (*Thuja occidentalis*)—This evergreen tree is typically found on moist cliffs and limestone seeps. One occurrence of this species is known from one parcel. In addition, two occurrences each were found on two other parcels. Twelve other populations of this species are known from Tennessee.

Ozark bunchflower (*Melanthium woodii*)—This summer-blooming herb grows in deciduous forests on rich, moist, wooded slopes. Because the *Melanthium* plants were not blooming, positive identification was not possible. Flowers are necessary to distinguish this species from the more common *M. parviflorum*. Potential populations of this Tennessee state-listed endangered plant were found on two parcels (one with five plants and the other containing three plants). These populations will be reinspected in 2001 to confirm their identity. Both parcels are allocated for Zone 3 (Sensitive Resource Management) because of other state-listed plants occurring on them. Three other populations of this species are known from the state of Tennessee.

Pink lady's-slipper (*Cypripedium acaule*)—This showy orchid is frequently harvested by plant diggers, but rarely survives being transplanted. The species is exceedingly difficult to

nursery propagate. Several individuals of this Tennessee state-listed endangered (commercially exploited) plant occur on six parcels. More than 160 populations of this species are known from the state of Tennessee.

Spreading false-foxglove (*Aureolaria patula*)—This fall-blooming herb typically grows in open stands of mixed hardwoods on limestone creek or river bluffs. Although often found in association with eastern red cedar, this Tennessee state-listed threatened plant occurs on four parcels. Fifty-seven populations of this species are known from the state of Tennessee.

3.3.1 - 2 Terrestrial Animals and Sensitive Ecological Areas

The various plant communities on Norris Reservoir provide suitable habitat for a variety of federal- and state-listed terrestrial animals. These diverse communities include pine forest, upland and riparian hardwood forest, wetland, and open-field habitats. In addition to distinctive vegetated communities, many features, such as streams, caves, rock communities, and sinkholes on reservoir parcels provide unique habitats for rare species of wildlife.

Prior to initiating field surveys on reservoir parcels, the TVA Regional Natural Heritage Project database was queried to identify federal and state protected terrestrial animals as well as sensitive ecological areas (e.g., caves and heron colonies) from counties adjacent to Norris Reservoir (Anderson, Campbell, Claiborne, Grainger, Hancock, and Union Counties in Tennessee). Twenty-two sensitive terrestrial animal species were identified from the database (Table 3-3). Four of these terrestrial animals are federally protected under the ESA and the remaining 18 are protected by the state of Tennessee. Terrestrial animal field surveys, restricted to specified TVA public land on Norris Reservoir, were conducted from April through October 1999. In each parcel, special emphasis was placed on locating populations of federal- and state-listed animals, uncommon habitats, and sensitive ecological areas. Protected terrestrial animals and sensitive ecological areas which were observed during the 1999 parcel surveys are also presented in Table 3-3. Four terrestrial animals were found during parcel surveys. Two of those animals were previously not known to be present in the Norris Reservoir vicinity. A total of 102 terrestrial animal species were observed or detected during field activities on surveyed parcels (Appendix C-1). Also, 82 caves and 4 heron colonies were noted from existing records.

TABLE 3-3 LISTS OF RARE TERRESTRIAL ANIMALS AND SENSITIVE ECOLOGICAL AREAS KNOWN TO OCCUR IN THE OF NORRIS RESERVOIR VICINITY FROM RECORDS (1999) AND PARCEL SURVEYS				
Common Name	Scientific Name	Federal Status	Tennessee State Status	Found During Parcel Surveys
<i>Amphibians</i>				
Eastern hellbender	<i>Cryptobranchus a. alleganiensis</i>	—	In Need of Management	—
Four-toed salamander	<i>Hemidactylum scutatum</i>	—	In Need of Management	—

TABLE 3-3 LISTS OF RARE TERRESTRIAL ANIMALS AND SENSITIVE ECOLOGICAL AREAS KNOWN TO OCCUR IN THE OF NORRIS RESERVOIR VICINITY FROM RECORDS (1999) AND PARCEL SURVEYS				
Common Name	Scientific Name	Federal Status	Tennessee State Status	Found During Parcel Surveys
Birds				
Peregrine falcon	<i>Falco peregrinus</i>	—	Endangered	—
Red-cockaded woodpecker	<i>Picoides borealis</i>	Endangered	Extirpated	—
Appalachian bewick's wren	<i>Thryomanes bewickii altus</i>	—	Threatened	—
Bald eagle	<i>Haliaeetus leucocephalus</i>	Threatened	In Need of Management	Yes (3 Parcels)
Common barn-owl	<i>Tyto alba</i>	—	In Need of Management	—
Northern saw-whet owl	<i>Aegolius acadicus</i>	—	In Need of Management	—
Little blue heron*	<i>Egretta caerulea</i>	—	In Need of Management	Yes (1 Parcel)
Sharp-shinned hawk	<i>Accipiter striatus</i>	—	In Need of Management	—
Osprey*	<i>Pandion haliaetus</i>	—	Formerly Threatened	Yes (1 Parcel)
Swainson's warbler	<i>Limnothlypis swainsonii</i>	—	In Need of Management	—
Mammals				
Gray bat	<i>Myotis grisescens</i>	Endangered	Endangered	—
Indiana bat	<i>Myotis sodalis</i>	Endangered	Endangered	—
Allegheny woodrat	<i>Neotoma magister</i>	—	In Need of Management	—
Common shrew	<i>Sorex cinereus</i>	—	In Need of Management	—
Eastern big-eared bat	<i>Corynorhinus rafinesquii</i>	—	In Need of Management	—
Eastern small-footed bat	<i>Myotis leibii</i>	—	In Need of Management	—
Hairy-tailed mole	<i>Parascalops breweri</i>	—	In Need of Management	—
Meadow jumping mouse	<i>Zapus hudsonius</i>	—	In Need of Management	—
Smoky shrew	<i>Sorex fumeus</i>	—	In Need of Management	Yes (3 Parcels)
Southeastern shrew	<i>Sorex longirostris</i>	—	In Need of Management	Yes (3 Parcels)

TABLE 3-3 LISTS OF RARE TERRESTRIAL ANIMALS AND SENSITIVE ECOLOGICAL AREAS KNOWN TO OCCUR IN THE OF NORRIS RESERVOIR VICINITY FROM RECORDS (1999) AND PARCEL SURVEYS				
Common Name	Scientific Name	Federal Status	Tennessee State Status	Found During Parcel Surveys
<i>Mammals - continued</i>				
Southern bog lemming	<i>Synaptomys cooperi</i>	—	In Need of Management	—
Woodland jumping mouse	<i>Napaeozapus insignis</i>	—	In Need of Management	—
*Species that were not known to occur in the Norris vicinity, but were found during the parcel surveys. Norris vicinity includes Anderson, Campbell, Claiborne, Grainger, Hancock, and Union Counties				

Bald eagle (*Haliaeetus leucocephalus*)—Bald eagles, listed as federally threatened and in need of management by the state of Tennessee, were observed on several occasions roosting and flying on or near TVA public land. Bald eagle populations continue to increase in Tennessee; however, nesting bald eagles are uncommon in east Tennessee. Large, mid-aged and mature tracts of deciduous woodlands adjacent to reservoirs provide both nesting habitat for resident eagles and wintering roosting habitat for migratory bald eagles. These birds regularly perch on snags adjacent to water when foraging. Suitable bald eagle nesting and foraging habitat is found on Norris Reservoir, especially along six parcels. Protecting large forested parcels and snags would benefit bald eagles. An active nest is located on private land along the Clinch River. Although birds are observed on Norris Reservoir during summer and winter months, no active nests are known on TVA public land.

Osprey (*Pandion haliaetus*)—Ospreys, formerly listed as threatened by the state of Tennessee, were observed on two occasions during the project while flying and foraging along the channel of Norris Reservoir. In recent years, osprey populations have increased in Tennessee due to the establishment of artificial nesting platforms. Ospreys are sensitive to human intrusion, and protective measures should be taken near their nesting sites. Suitable nesting and foraging habitat for this species is found on multiple reservoir parcels. Protecting snags and mature woodlands along the reservoir would benefit this species. Although birds were observed occasionally, no nesting activity was confirmed on TVA parcels.

Little blue heron (*Egretta caerulea*)—Little blue herons, listed as in need of management by the state of Tennessee, were observed roosting on one parcel. The little blue heron is an uncommon colonial nesting bird that nests in woods or thickets near water and forages along mudflats and in shallow water. In Tennessee, this heron occurs predominately in the western part of the state. This bird is most commonly observed in east Tennessee during migration periods. Suitable habitat for the little blue heron exists on the reservoir. Protection of areas consisting of shallow water and mudflats bordered by woodlands along Norris Reservoir would benefit this bird. Nesting of this species was not confirmed on any parcels.

Southeastern shrew (*Sorex longirostris*)—Southeastern shrews, listed as in need of management by the state of Tennessee, are found in a variety of habitats across Tennessee, including moist forests and wetlands. Southeastern shrews were documented by five sightings on three parcels. Suitable habitat for this species is found on most parcels and additional sampling efforts on parcels would likely yield more records for this mammal.

Smoky shrew (*Sorex fumeus*)—Smoky shrews, listed as in need of management by the state of Tennessee, can be found in moist woodlands with ample leaf litter and in grassy areas along streams. In Tennessee, this mammal generally occurs in the eastern part of the state where limited information about the species is available. Smoky shrews were documented by four occurrences on three parcels. Several parcels on the reservoir provide suitable habitat for this species. Protection of moist woodland habitats and wetlands along the reservoir would benefit this species.

Caves—Caves represent very specialized habitats and a significant number of federal- and state-listed species find suitable habitat within caves. Cave habitats are used year-round, as roosting and maternity sites by federally endangered bats. Caves are used as nest sites by the state-listed Allegheny woodrat and common barn-owl. Several sensitive species, which rely on caves (gray bat, Indiana bat, eastern small-footed bat, eastern big-eared bat, Allegheny woodrat, and common barn-owl), have been documented in the vicinity of Norris Reservoir.

Appendix C-2 provides a list of bats known from caves which occur in the vicinity of Norris Reservoir. Caves and suitable foraging areas are important habitat requirements for these species. Gray bats typically forage over large bodies of water and Norris Reservoir provides ample foraging habitat for this species. Woodland streams and hillsides and wetlands associated with the reservoir provide foraging habitat for the eastern-small-footed bat and eastern big-eared bat; and upland forests and forested riparian habitats provide foraging habitat for the Indiana bat. Forested areas characterized by mature trees, hollow trees, and snags are suitable habitat for woodland species of bats, including the Indiana bat. In July 1999, bats were surveyed using mist nets at five locations on two parcels, which resulted in the capture of three species of bats: northern red bat, little brown bat, and big brown bat.

Heron colonies—Heron colonies are colonial nesting sites used by migratory wading birds. Several species of birds, in large numbers, may nest in colonies. Birds that occupy these colonies are sensitive to disturbance, especially during the nesting season. Norris Reservoir, including many parcels, provides suitable foraging and nesting habitat for these birds.

Two new heron colonies were discovered during field surveys. The first colony, located in a hardwood/pine forest on the crown of a steep peninsula adjoining Beech Island Small Wild Area, contained 25 to 30 nests of great blue herons. The second colony, containing seven great blue heron nests, is located on a parcel in shoreline pines. The establishment of heron colonies on Norris Reservoir is significant. Great blue heron populations in Tennessee underwent declines in the late 1960s and early 1970s (Nicholson, 1997). These new occurrences suggest that the reservoir may provide suitable nesting habitat for other species of wading birds that are considered uncommon in Tennessee, such as the little blue heron. Additionally, the reservoir provides habitat for regional populations of herons which may

relocate there due to human disturbance or loss of habitat in other areas. Additional suitable habitat for wading birds is present along the reservoir.

No populations of the remaining rare animal species listed in Table 3-3 were found during field surveys. However, suitable habitat exists on Norris Reservoir for many of these species. The presence of sensitive terrestrial animal species were projected based on the geographical range of the species and the presence of habitat deemed suitable for the respective species found in Choate, Jones, and Jones, 1994; Harvey, 1992; Nicholson, 1997; Petranka, 1998; Redmond and Scott, 1996; Whitaker and Hamilton, 1998; and Wilson, 1995.

Early successional habitats, such as old fields, along the reservoir provide suitable habitat for common barn-owls (*Tyto alba*), and the Appalachian bewick's wren (*Thryomanes bewickii altus*). Sharp-shinned hawks (*Accipiter striatus*) nest in woodlands and may forage in early successional habitats.

A diversity of forested areas provide habitat for a variety of rare animals. Rock communities and caves provide suitable habitat for the Allegheny woodrat (*Neotoma magister*) and eastern small-footed bat (*Myotis leibii*). Woodland jumping mice (*Napaeozapus insignis*) may be found along the reservoir in mature woodlands and wetlands. Damp woodlands and wetlands provide habitat for the southern bog lemming (*Synaptomys cooperi*) and common shrew (*Sorex cinereus*). The meadow jumping mouse (*Zapus hudsonius*) and hairy-tailed mole (*Parascalops breweri*) may find suitable habitat in both woodland and open habitats along the reservoir.

Wetlands and other aquatic habitats on reservoir parcels provide habitat for four-toed salamanders (*Hemidactylium scutatum*). This salamander prefers woodlands containing abundant moss or sedges near a water source. Eastern hellbenders (*Cryptobranchus a. alleganiensis*) inhabit cool unpolluted waters and may be found along several parcels.

No suitable habitat for red-cockaded woodpeckers (*Picoides borealis*) or the peregrine falcon (*Falco peregrinus*) was observed on Norris Reservoir parcels. Although stands of pine were observed, none were of suitable age or were extensive enough to provide suitable nesting habitat for the red-cockaded woodpecker. TWRA listed the red-cockaded woodpecker as extirpated in Tennessee in 2000. Limited habitat exists on reservoir parcels for the peregrine falcon. Swainson's warblers (*Limnothlypis swainsonii*) nest in forests containing dense undergrowth and may be associated with ravines. This habitat type was not encountered on any parcels. The northern saw-whet owl (*Aegolius acadicus*) can be found in mixed-deciduous woodlands; however, records for this species are sparse throughout the region and it would not be expected on reservoir parcels, except rarely during migration.

Several species, not currently known from areas surrounding the parcels, may find suitable habitat along the reservoir. Forested habitats along the reservoir provide suitable habitat for the long-tailed shrew (*Sorex dispar blitchi*), southern coal skink (*Eumeces anthracinus pluvialis*), and northern coal skink (*Eumeces anthracinus anthracinus*). Open country provides habitat for the northern harrier (*Circus cyaneus*), vesper sparrow (*Pooecetes gramineus*), Bachman's sparrow (*Aimophila aestivalis*), and the eastern slender glass lizard

(*Ophisaurus attenuatus longicaudus*). Wetland and riparian areas provide habitat for the great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), least bittern (*Ixobrychus exilis*), king rail (*Rallus elegans*), and star-nosed mole (*Condylura cristata parva*).

3.3.1 - 3 Aquatic Animals

Several aquatic species now protected as either federal- or state-listed endangered or threatened species existed in the reservoir area prior to impoundment. Those species include several freshwater mussels (such as the dromedary pearlymussel, *Dromus dromas*; green blossom pearlymussel, *Epioblasma torulosa gubernaculum*; shiny pigtoe pearlymussel, *Fusconaia cor*; fine-rayed pigtoe, *Fusconaia cuneolus*; and birdwing pearlymussel, *Lemiox rimosus*) and a few fishes (such as the palezone shiner, *Notropis albizonatus* and spotfin chub, *Cyprinella monacha*). Information available in the TVA Regional Natural Heritage Project database and other sources indicates that most of these species are unlikely to occur in the types of habitats present in the reservoir pool. Some state- and federal-protected aquatic species are either known to occur or might still persist in parts of the Clinch and Powell Rivers adjacent to some upstream parcels of land considered in the Norris Plan. These species are identified in Table 3-4. Those which might still be present in the area are discussed in the following paragraphs.

TABLE 3-4 PROTECTED AQUATIC ANIMALS KNOWN FROM AREAS ADJACENT TO PARCELS INCLUDED IN THE NORRIS RESERVOIR LAND MANAGEMENT PLAN				
Common Name	Scientific Name	Federal Status	Tennessee State Status	Possible Near Plan Parcels?
Mussels				
Birdwing pearlymussel	<i>Lemiox rimosus</i>	Endangered	Endangered	X
Dromedary pearlymussel	<i>Dromus dromas</i>	Endangered	Endangered	X
Fine-rayed pigtoe	<i>Fusconaia cuneolus</i>	Endangered	Endangered	X
Green blossom pearlymussel	<i>Epioblasma torulosa gubernaculum</i>	Endangered	Endangered	X
Shiny pigtoe pearlymussel	<i>Fusconaia cor</i>	Endangered	Endangered	X
Fish				
Palezone shiner	<i>Notropis albizonatus</i>	Endangered	Endangered	X
Slender chub	<i>Erimystax cahni</i>	Threatened	Threatened	P
Spotfin chub	<i>Cyprinella monacha</i>	Threatened	Endangered	X
Tangerine darter	<i>Percina aurantiaca</i>	None	In Need of Management	P
Western sand darter	<i>Ammocrypta clara</i>	None	Threatened	P
Yellowfin madtom	<i>Noturus flavipinnis</i>	Threatened	Threatened	?
P = Possible ? = Unknown X = Assumed Extirpated				

Tangerine Darter (*Percina aurantiaca*)—This darter is known from the upper Tennessee River drainage from its headwaters in southwestern Virginia downstream as far as the Hiwassee River system in Tennessee, North Carolina, and northeast Georgia. Tangerine darters are found in medium-sized creeks and rivers, including free-flowing portions of the Clinch and Powell Rivers above Norris Reservoir. They normally occur in deep riffles and boulder-strewn runs and pools over substrates of bedrock, boulders, cobble, gravel, and sand that are relatively free of silt (Etnier and Starnes, 1993; Shute et. al., In Press).

Slender Chub (*Erimystax cahni*)—This minnow has been collected recently only in the Clinch and Powell River systems upstream from Norris Reservoir; although, historically, it was also known from the Holston River. The free-flowing portions of the Clinch and Powell Rivers above the Norris Reservoir impoundment are designated critical habitat for the slender chub (USFWS, 1983). No recent records are available for this species from within the impoundment area. Slender chubs appear to prefer gravel shoal areas in large rivers (Etnier and Starnes, 1993; Shute et. al., In Press).

Western Sand Darter (*Ammocrypta clara*)—The western sand darter is widespread in streams in the Mississippi and Ohio River systems, including portions of the Cumberland and Tennessee watersheds. This darter is known in Tennessee only from the Clinch and Powell Rivers above the impoundment of Norris Reservoir. It has been collected recently only in the Powell River. Western sand darters occur in small to large rivers in areas having moderate current over clean sand or sand and gravel substrates (Etnier and Starnes, 1993; Shute et. al., In Press).

Yellowfin Madtom (*Noturus flavipinnis*)—Unimpounded portions of the Powell River are designated critical habitat for the yellowfin madtom (Greenwald, 1977). Yellowfin madtoms have been recently found in the mainstem Powell River upstream from Norris Reservoir (P. W. Shute, TVA, personal observation). No recent records are available for this species from within the impoundment area.

3.3.2 *Environmental Consequences*

3.3.2 - 1 Plant Species

Alternative A—Under this alternative, use of TVA public land on Norris Reservoir would continue to be based on the Forecast System. The Forecast System does not currently include any areas, other than TVA Small Wild Areas, reserved primarily for protection of natural resources. There are 39 reported occurrences of state-listed plant species on plan land. Under the Forecast System, 35 of these occurrences are on land designated for Public Recreation, three are on a parcel designated for Steam Plant Study, and one on land designated for Forestry Research.

If the Forecast System continues to be used, potential impacts to state-listed threatened and endangered plants would be assessed during site-specific reviews. Each proposed land use would be reviewed, and its anticipated impacts to existing vegetation, including rare plants,

would be evaluated. Some Forecast System uses would likely be modified, based on the environmental review process. However, the review process would ensure that impacts to state-listed plants are minimized. Under the Forecast System, no land is managed specifically for the protection and enhancement of the rare plant populations present.

Alternative B—This alternative would provide protective status for 14 parcels containing 39 listed plant occurrences. Twelve of these parcels (95 percent) are in Zone 3 under the Norris Plan, and the remaining two parcels (14 percent) are in Zone 4. In Zone 3, the overriding focus is protecting and enhancing the sensitive resource the site supports (see Section 2.2.2). Parcels in Zone 4 are managed for the enhancement of natural resources for human use and appreciation. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on threatened and endangered plant species.

Conclusion—Under either alternative, individual land use proposals would be reviewed under the National Environmental Policy Act (NEPA) to determine potential effects on plant species. These activities would be approved, denied, or approved subject to modification of the activity to reduce potential environmental effects. Also, both alternatives would use the most recent plant survey information. Under Alternative A, this new information about the types and location of listed plants would be used to improve the use of the Forecast System. Consequently, if left in place, the Forecast System is expected to have a minimal effect on threatened and endangered plants.

If Alternative B is implemented, 95 percent of the land containing listed plants would be allocated to Zones 3 and 4 (Sensitive Resource Management and Natural Resource Conservation, respectively). Because both zones provide for increased protection and enhancement of the rare plants present, the Norris Plan is anticipated to provide better protection for listed plants. Alternative B is expected to benefit listed plants and is preferred over Alternative A.

3.3.2 - 2 Terrestrial Animals

Alternative A—Currently, decisions regarding the use of TVA public land surrounding Norris Reservoir are based upon the Forecast System. Effects to populations of rare terrestrial animals and sensitive ecological areas (caves and heron colonies) would be considered during TVA environmental reviews associated with specific projects; therefore, no significant impacts to threatened or endangered terrestrial animals are expected. Although this process would protect most populations of rare terrestrial animals and sensitive ecological areas along the reservoir, TVA's ability to address cumulative impacts to these resources would be limited.

Alternative B—Using the land planning allocation process, parcels that harbor populations of rare terrestrial animals or sensitive ecological areas would be designated for Zone 3, Sensitive Resources Management or Zone 4, Natural Resources Conservation. This process would protect populations of federal- and state-listed species, significant rare species habitat,

and sensitive ecological areas. In parcels designated for natural resource conservation, habitat manipulation would be allowed to improve this habitat for wildlife.

This alternative would benefit rare terrestrial animals, their habitat, and sensitive ecological areas by applying appropriate protective buffers around them. Ultimately, unit plans would be developed for TVA public land surrounding Norris Reservoir. These plans would specifically designate protective zones for populations of rare terrestrial animals, their habitat, and sensitive ecological areas, and specify wildlife management requirements and limitations for the reservoir. For these stated reasons, Alternative B is preferred over Alternative A. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on threatened and endangered terrestrial animals.

3.3.2 - 3 Aquatic Animals

Alternative A—Under this alternative, TVA actions would not be likely to adversely affect the habitat of protected aquatic species. While four state- and/or federal-listed fishes could occur in portions of the Clinch and Powell Rivers upstream from the land included in the Forecast System, current environmental review practices would likely avoid or minimize any adverse impacts to these species.

Alternative B—Under this alternative, no parcels were identified specifically to protect habitats necessary for sensitive aquatic species. However, adoption of this alternative would lead to the protection of several large areas containing wetlands and sensitive terrestrial habitats. Many of these areas would act as riparian buffer zones and could have indirect but positive effects on aquatic habitat quality. The cumulative effects of these actions may help improve water quality and aquatic habitats downstream from these parcels, including areas where sensitive aquatic species may occur. Therefore, this alternative could afford these species and/or habitats greater protection than the current Forecast System. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on threatened and endangered aquatic animals.

3.4 Terrestrial Ecology and Significant Natural Areas

3.4.1 Affected Environment

3.4.1 - 1 Terrestrial Ecology

Norris Reservoir is located within the great Valley of east Tennessee, or geographically what is described as the Appalachian Ridge and Valley physiographic province of east Tennessee. This physiographic province is characterized by long ridges and intervening valleys that generally run in a southwestern-to-northeastern direction. Norris Reservoir land is within the oak-hickory forestland resource region, as described by the U.S. Forest Service (USDA Forest Service, 1969).

The 27,926.8 acres of TVA public land surrounding Norris Reservoir can be divided into three broad community types: (1) forestland; (2) open land; and (3) wetland/riparian areas. Approximately 22,262 acres has been inventoried as part of the TVA forest prescription process. Of this land, the following major cover types occur:

- Hardwoods (15,184 acres—68 percent)
- Mixed (4,443 acres—20 percent)
- Pines (1,745 acres—8 percent)
- Red Cedar (332 acres—1 percent)
- Open (412 acres—2 percent)
- Other (146 acres—1 percent)

Past land use has played a major role in creating the present mosaic of forest conditions. At the time of TVA purchase, TVA public land on Norris Reservoir was typical of other land in the Tennessee Valley; primarily small subsistence farming on marginal land with pastures and row crop areas interspersed with woodlands. Pasture and row crops made up a majority of the landscape while most woodland areas were grazed and often burned to promote the growth of annuals and other forage plants. Woodlots were also selectively harvested periodically to provide construction lumber, firewood, and other wood products. After purchase, open land was either planted to shortleaf pine by TVA or reverted naturally to Virginia pine, red cedar, hickory, and other hardwoods.

Two events during the 1970s had major impacts on the forest resources on Norris Reservoir. The first event, TVA entered into a 10-year contract with Longleaf Industries for harvest 40 million board feet of timber from Norris Reservoir land. All harvesting was done using a selection system, with a moratorium on regeneration harvests. This ultimately resulted in “high-grading,” which had detrimental long-term effects on Norris Reservoir land. The second event was the epidemic outbreak of the southern pine beetle in the early and mid-1970s. This infestation caused heavy mortality in the old-field pine stands and greatly diminished the composition of pine on Norris Reservoir.

Although a variety of hardwood types are present on Norris Reservoir, upland hardwood comprises over 76 percent of the hardwood stands. Typical species that occur in these are white oak, black oak, southern red oak, hickories, red maple, and beech. Mixed hardwood stands, that are composed primarily of upland and cove hardwood, comprise about 14 percent of the hardwood. Other hardwood types include cove, northern, and bottomland. Typical species in these types include yellow-poplar, sugar maple, white ash, chinkapin oak, beech, black willow, sycamore, and persimmon. Past logging activity has resulted in stands of various ages that have two main age classes: the older trees exceed 100 years while the younger component is generally 30 to 40 years old. Because of the advanced age, most of the dominant hardwood is small and large sawtimber size.

Pine types are dominated by Virginia pine (56 percent), mixed pine (31 percent), and planted shortleaf pine (8 percent). The remaining pine types include planted loblolly and white pine. Most of the pine exceeds 50 years of age and is pole- and small-sawtimber-size. Mixed foreststands comprise 20 percent of the forest and include cedar-hardwood, pine-cedar, pine-

hardwood, and pine-cedar-hardwood types. These types have various mixtures of red cedar, Virginia and shortleaf pine, elm, oaks, hickories, red maple, and other hardwoods. These types range in size from poles to large sawtimber and are a variety of age classes. Also, as a result of old-field reversion, eastern red cedar occurs on poorer, rocky sites that were either marginal farmland or were heavily depleted of soil nutrients.

In 1981 TVA implemented an inventory and prescription process to standardize forest management planning for its land. Using this approach, staff foresters inventoried approximately 10 percent of TVA's forested land annually. Based on these annual inventories, forest management prescriptions were developed and reviewed by various TVA interests (water quality, wildlife, aesthetics, cultural resources, etc.). Utilizing input received during these reviews, prescriptions were either approved, modified, or disapproved. Thereafter, approved prescriptions were evaluated to determine the nature and significance of anticipated environmental effects. The remaining 5,604.8 acres of TVA public forestland surrounding Norris Reservoir has not been inventoried and includes a variety of conditions. This land includes properties fronting residential development, state parks, and wildlife management areas. It also includes unmanaged forest areas, recreation and natural areas, riparian/wetland areas along streams and the lakeshore, portions of Norris Dam Reservation, and the city of Norris' watershed area. These parcels range in size from less than 2 acres to over 450 acres. For example, Parcel 7, approximately 450 acres is managed by the city of Norris, with TVA assistance, for their municipal watershed. Ecological conditions and forest communities occupying this land is similar to inventoried reservoir land except some marginal strip land fronting residential development may have been cleared for mowed lawns or the forested areas cleared of underbrush.

Open land on Norris Reservoir is composed of managed TVA public land licensed to individuals for agricultural purposes and TVA public land purposely maintained as open land for the enhancement of wildlife habitat. TVA agricultural licensed land consists of 498 acres in 20 parcels, licensed primarily for hay production. Open land leased by individuals for agricultural purposes must be maintained using BMPs as outlined by TVA in the license agreements and commitments in TVA's Agricultural EA (1999). Many of the tracts of open land licensed on Norris Reservoir for agricultural purposes have been managed to improve wildlife habitat in conjunction with approved agricultural practices. Various stages of transitional habitat for resident wildlife species have been created along field borders, fence rows, and woodlots associated with these agricultural tracts. TVA maintained open land is managed to provide various types of early succession wildlife habitat, such as old fields and meadows. Old fields and edge areas include a variety of shrubs, vines, forbs, weeds, tree seedlings, and grasses. These old field communities might include dogwoods, maples, sumac, honeysuckle, ironweed, ragweed, thistle, beggarweed, blackberries, and broom-sedge. Meadows may include planted native warm season grasses, clovers, lespedeza, orchard grass, and wheat. Many areas have been managed to improve wildlife habitat using prescribed burns, mowing, disking, planting wildlife food crops, and establishing native warm season grasses.

TVA has also taken action to establish and promote riparian vegetation on TVA public land along streams and lakeshores to provide wildlife habitat, protect water quality, and minimize

soil erosion. Riparian areas along streams and lakeshores include forested buffer strips, reverting old fields, shoreline fringe wetlands, and mowed lawns adjacent to residential areas. The wetland communities found on Norris Reservoir make up the smallest percentage of the community types considered and are addressed in Section 3.5.

The forested upland, openland, and riparian/wetland community types surrounding Norris Reservoir provide a broad range of habitats capable of supporting a wide array of terrestrial wildlife species. Mammals commonly found in these habitats include gray and fox squirrels, white-tailed deer, woodchucks, and white-footed mice. Bird species using these habitats throughout the year include eastern wild turkey, various woodpeckers, eastern bluebirds, song sparrows, and northern cardinals. Migrant neotropical songbirds, such as yellow-billed cuckoos, red-eyed vireos, yellow-throated warblers, and indigo buntings may be observed during spring and summer. Eastern box turtles, black rat snakes, and five-lined skinks are common reptile species also utilizing these widely varied habitats. The wildlife species expected to occur in the major ecological community types on Norris Reservoir are listed in Appendix C-1. Forested areas and managed open land make up 85 percent of the 27,926.8 acres of TVA public land on Norris Reservoir.

Strips of TVA public land (below the 1044-foot contour elevation) separate the reservoir shoreline and private residential land in some areas. These residential-influenced strips of land are located along 131 miles of shoreline. On an additional 133 miles of residential access shoreline on Norris Reservoir, TVA does not own any land above normal summer pool (1020-foot contour elevation). Combined, these residential access areas make up 32 percent of the total reservoir shoreline. On these residential access areas the backlying private property landowners have deeded rights to request permits for water use facilities and implementation of vegetation management plans on TVA public land. Any permit request is reviewed to assess potential impacts to protected terrestrial wildlife and plant species. All requests must follow TVA's SMP standards (Section 1.2 explains the SMP). SMP standards were developed to minimize impacts to terrestrial ecology on residential access land. These standards were evaluated in TVA's SMI Final EIS (April, 1999).

3.4.1 - 2 Significant Natural Areas

The following criteria was used to evaluate each parcel for its potential for natural area designation:

- ***Aesthetics*** includes the presence of unique natural features (waterfalls, mature trees, wildflower displays, concentrations of observable wildlife, panoramic views).
- ***Solitude*** is a measure of the parcels' isolation from developed landscapes and ability to provide a quiet place in the natural world without the background sounds of urban, industrial, and residential activities.

- **Access** includes ease of access from public roads, the ease of development of parking areas, as well as a determination of whether the topography of the parcel is favorable for trail development.
- **Ecological integrity** is the capability to protect the resource, minimize visual intrusions, separate incompatible uses, and the presence or absence of invasive, exotic species.
- **Environmental Education and Scientific Research** indicates the site has potential to be used for wildlife viewing opportunities, environmental education, and scientific research. These are often unique or uncommon ecological communities, or habitats important to migratory wildlife or easily observable species.
- **Threatened and Endangered Species Habitat** is a site with the known occurrence of plant or animal species with federal or state status.

There are eight significant ecological sites or managed areas on Norris Reservoir. Six of these areas (Beech Island, Comby Ridge, Hemlock Bluff, Monks Corner, Stiners Woods, and River Bluff) are TVA Small Wild Areas and are managed for low impact public use, such as hiking. One area (Norris Dam Cave) is a TVA Habitat Protection Areas and is managed for the protection of federal and/or state protected species. One area, the Norris Song Bird Trail is a State Wildlife Observation Area and is managed for various types of viewable wildlife.

Beech Island TVA Small Wild Area (Parcel 276)—This small wild area, located in Union County on the Clinch River arm of Norris Reservoir, includes 13 acres of beech-maple forest, and numerous steep ridges and cliffs overlooking the reservoir. Trails wind through upland hardwood forests floored with numerous wildflower species. This area has been proposed as a Potential National Natural Landmark.

Comby Ridge TVA Small Wild Area (Parcel 225)—This small wild area, located in Claiborne County near Big Sycamore Creek, is composed of 75 acres of upland and cove hardwoods along a steep narrow ridge. This ridge forms a geologic feature uncommon in the ridge and valley region.

Hemlock Bluff TVA Small Wild Area (Parcel 308)—This 177-acre small wild area, located in Union County on Norris Reservoir, is unique because of numerous hemlocks growing on a steep limestone ridge. A seven-mile loop hiking trail winds through a mixed forest that includes hemlock, white oak, beech, and pine. This area has been proposed as a Potential National Natural Landmark.

Monks Corner TVA Small Wild Area (Parcel 123)—This small wild area, located in Union County and lies adjacent to Chuck Swan Wildlife Management Area, includes 145 acres of upland hardwoods on saw-back ridges with numerous limestone outcrops. Numerous spring and fall wildflowers can be found at Monks Corner. Recreation opportunities include hiking trails and limited primitive camping.

Norris Dam Cave TVA Habitat Protection Area (Parcel 6)—This habitat protection area, located in Campbell County immediately downstream from Norris Dam on the west bank of the Clinch River, includes approximately six acres that provides habitat (April through October) for a colony of about 8,000 gray bats (*Myotis grisescens*).

Norris Song Bird Trail State Wildlife Observation Area (Parcel 6)—Song Bird Trail, located below Norris Dam on the Clinch River, provides a variety of habitats (including riverine, old fields, bottomland hardwoods, and grassy areas) for many songbirds and other wildlife. A special feature is the high concentration of eastern bluebirds breeding in the area. Osprey and bald eagles can occasionally be seen along the river.

River Bluff TVA Small Wild Area (Parcel 6)—This small wild area is located on the Norris Dam Reservation in Anderson County. Composed of 125 acres of rich, mixed mesophytic forest on a steep north facing slope, this area harbors a rich assemblage of wildflowers, including several rare species. A 3.1-mile loop hiking trail provides access to a 40-year-old pine plantation, rich vegetation, and steep bluffs overlooking the Clinch River. Numerous species of wildlife utilize this forest, including deer, songbirds, and wild turkey.

Stiners Woods TVA Small Wild Area (Parcel 122)—This small wild area contains a beech dominated mixed mesophytic forest. The area is of historical significant because of carvings on several of the beech trees. In addition, this 57-acre area provides habitat for an active vulture roost.

3.4.2 Environmental Consequences

3.4.2 - 1 Terrestrial Ecology

Alternative A—Approximately 69 percent of TVA public land on Norris Reservoir is under either the public recreation, small wild area, forest research, or wildlife management designations. Approximately 65 percent of this land is designated for public recreation, which allows a wide variety of potential uses and management options ranging from undeveloped to developed recreation. These developed changes might include the creation of parks, the building of boat launching sites, and developed campgrounds. Therefore, changes in use patterns under the public recreation designation could create a corresponding change in vegetation and terrestrial ecology of the affected parcels. However, these types of impacts would be localized and insignificant on a regional or sub-regional basis. Overall the cumulative impacts to terrestrial ecology under Alternative A would be insignificant on TVA's forestland, open land, and riparian areas.

Alternative B—This alternative allocates 23,775.8 acres to Sensitive Resource Management (Zone 3) and Natural Resource Conservation (Zone 4). These two zones comprise approximately 85.1 percent of TVA public land on Norris Reservoir. The management of these parcels would be guided by unit management plans, developed and reviewed with public input, which would provide for a long-term (25 years) management strategy for natural resource management. There would be approximately seven such units ranging in size from

1,500 acres to 4,000 acres. The following types of activities could occur in a given unit, following site-specific environmental review:

- Forest management to improve the diversity of tree species and sizes; encourage growth and maturation of native fruit- and nut-producing trees; develop wildlife openings and various successional stages of wildlife habitat; and protect snags and wildlife nesting cavities.
- Open land management to provide a diversity of vegetation, ranging from planted native warm season grasses to old fields and shrub edges.
- Wetland management to protect and/or enhance the hydrology, soils, and vegetation as well as to improve overall functions and values.
- Riparian management to allow the natural development of native vegetation or restoration of riparian vegetation through soil bioengineering.
- Management and protection of sensitive terrestrial resources and natural areas in accordance with existing regulations, requirements, and principles of good stewardship.
- Public use management, including hiking trails, informal camping, fishing access sites, and parking areas.

The proposed Norris Plan allocated land to Zones 3 and 4 based on resource inventories and capability/suitability analyses conducted for the Norris Plan. As a result, the above types of management activities would result in beneficial impacts to terrestrial ecological resources on these parcels.

Fifteen percent of TVA public land on Norris Reservoir includes 934.5 acres allocated to Project Operations (Zone 2), 1,743.9 acres allocated to Recreation (Zone 6) and 1,472.6 acres allocated to Residential Access (Zone 7). In the SMI Final EIS (TVA, 1999a), TVA concluded that there would not be any significant cumulative impacts to terrestrial ecology on TVA public land fronting residential development. Any Zone 2 areas developed for TVA Project Operations will be reviewed by TVA prior to any development to ensure that any impacts to terrestrial resources will be avoided or minimized. Development within parcels allocated to Zones 2 and/or 6 would have insignificant effects on terrestrial ecology on a regional or subregional basis.

Privately-owned forests and open land are likely to be subject to increased pressure in the surrounding area primarily from residential development. By maintaining more than three-fourths of TVA public land in forested and open land parcels, implementation of Alternatives A or B could offset some negative effects of development and fragmentation on nearby private land. However, because of the small percentage of TVA acreage within the region, TVA's choice of an alternative for management of public land would be unlikely to influence regional trends in terrestrial ecology. Selection of Alternative B would have a beneficial effect on the terrestrial ecology on TVA public land. The TVA technical review

process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on terrestrial ecology.

3.4.2 - 2 Significant Natural Areas

Alternative A—Under the Forecast System, all existing natural areas will continue to be managed in a manner consistent with no significant impacts. However, since no new areas are identified as natural area candidates, Alternative A would have somewhat less positive impact than Alternative B.

Alternative B—Field surveys of selected, uncommitted planning parcels were conducted between April and November of 1999. The purpose of the surveys was to evaluate the parcels for their scenic and aesthetic qualities, ecological significance, and suitability for designation as a TVA Natural Area. TVA Natural Areas include small wild areas, ecological study areas, habitat protection areas, and wildlife observation areas. See the Zone 3 definition in Table 2-4 for a description of each of these natural areas.

Based on the survey findings, all or portions of nine parcels meet the criteria for designation as a TVA Natural Area. All nine of these areas are suitable for designation as TVA Habitat Protection Areas because of the presence of plant species with Tennessee state status.

Habitat Protection Area designation include:

- Parcel 5 - Clinch River Bluffs TVA Habitat Protection Area
- Parcel 10 - Oak Grove River Bluffs TVA Habitat Protection Area
- Parcel 13 - No Rope Cave TVA Habitat Protection Area
- Parcel 36 - Cove Creek Bluffs TVA Habitat Protection Area
- Parcel 52 - Big Creek TVA Habitat Protection Area
- Parcel 74 - Murrayville Flats TVA Habitat Protection Area
- Parcel 145 - Gap Creek Bluffs TVA Habitat Protection Area
- Parcel 181 - Little Barren Creek TVA Habitat Protection Area
- Parcel 182 - Cedar Grove TVA Habitat Protection Area

These habitats and the species present are described in the Threatened and Endangered Species section of this report. Although no areas were identified as suitable for designation as new TVA Small Wild Areas, under Alternative B 25 acres will be added to the existing Monks Corner TVA Small Wild Area.

Because Alternative B has a specific zone for sensitive resource management and allows for expansion of an existing Small Wild Area, this is the preferred alternative. Alternative B would have a beneficial impact on Significant Natural Areas. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on significant natural areas.

3.5 Wetlands/Riparian Ecology

3.5.1 Affected Environment

Wetlands are typically transitional ecosystems between terrestrial and aquatic communities. In the Ridge and Valley Physiographic Province, lower slope/terraced land and floodplains represent a small percentage of the landscape relative to the uplands due primarily to the geology of the region. Wetlands generally include swamps, marshes, bogs, and similar areas, such as sloughs, potholes, wet meadows, mud flats, and natural ponds (TVA, 1983).

Wetlands along TVA's reservoirs tend to be diverse and highly productive components of the overall reservoir ecosystem. They provide habitat for many wildlife species, serve as shoreline stabilization zones, aid in flood control, and contribute to improved water quality. Most wetlands on Norris Reservoir are found in shallow coves or embayments. They generally are in linear strips, ranging in size from one-tenth of an acre to 60 acres in size, following the shape of the shoreline and below the 1020-foot contour elevation (normal summer pool).

Along reservoir shorelines, wetlands and riparian areas are transitional ecosystems between terrestrial and aquatic communities. Historically, there were no lakes in the upper Tennessee River basin. TVA's impoundments inundated the previous riverine and upslope habitats creating new wetland areas and many miles of terrestrial shoreline riparian habitat, which consist of summer shoreline riparian zones and winter drawdown mud flats (Amundsen, 1994).

The wetlands of Norris Reservoir primarily lie along approximately 133.5 miles of shoreline. These fringe and reservoir wetlands influence 16.5 percent of Norris Reservoir's 809.2 miles of shoreline and embody a variety of wetland habitat types, including aquatic beds, emergent, scrub/shrub, and forested wetlands all of which can be found as isolated or mixed units. The small percentage of wetland acreage, when compared to all TVA public land on Norris Reservoir, does not diminish their overall importance. In fact, it serves to increase and focus their importance within the system, as it tends to concentrate the wildlife species utilizing these habitat types. Many of these species found in wetland habitats are listed in Appendix C-1.

Three of the most significant reservoir-influenced wetland areas on Norris Reservoir are found in the Big Sycamore Creek, Indian Creek, and Lost Creek areas. These wetland areas range in size from approximately 20-60 acres. The Big Sycamore Creek and the Indian Creek wetland areas are adjacent to Parcels 222, 223, and 239. They are located on the east side of U.S. Highway 25E. The Lost Creek wetland is located next to Parcel 166 adjacent to a large TVA licensed agricultural tracts in Parcel 167 and bounded to the east by private agricultural pastures and Lost Creek Campground. These wetland areas are the largest on Norris Reservoir, and provide valuable brood rearing areas for wood ducks in the spring and feeding areas for migrating waterbirds in the fall.

Also of special significance on Norris Reservoir are smaller, isolated wetland areas not influenced directly by reservoir fluctuations. Such a wetland exists on Parcel 254. It is a

half-acre herbaceous wetland associated with a shallow, meandering rocky stream located near the center of the parcel. The wetland area has a thick layer of organic material (not sphagnum) that creates a quaking bog effect. This area is unique, as wetlands of this type are rare on Norris Reservoir. There are two other significant wetland areas on Norris Reservoir which are associated with agricultural licenses. These two areas are located in Parcels 239 and 327. The wetland in Parcel 239 is upstream from the reservoir influenced areas mentioned previously, and is maintained in an emergent-successional stage by allowing restricted grazing and mowing. The wetland area on Parcel 286 is along Crooked Creek and has been fenced to protect it from grazing cattle. This area is being restored to its original forested condition by replanting wetland tree species.

Norris Reservoir's riparian zone and winter mud flats offer important habitats for many waterfowl, wading birds, and shorebird species. During the high pool months these areas offer feeding, resting cover, and breeding areas for wood ducks. Shoreline with high banks over the water provide cavity nesting sites and feeding territory for belted kingfishers. Wading birds, such as great blue herons, use riparian zones and wetlands for cover and feeding. Exposed mud flats present during the winter drawdown period provide feeding sites for resident and migrant shorebirds, such as killdeer and sandpipers.

Wetland and riparian areas are also important to mammalian groups as well. Muskrats and beaver feed along wetland and riparian zone edges, as well as build bank dens for young rearing and protection. Predator species, such as mink, hunt along the banks and shorelines for prey species which also use these zones.

3.5.2 Environmental Consequences

Alternative A—Wetland areas located on TVA public land surrounding Norris Reservoir are found in most of the Forecast System categories. Under Alternative A, these areas would most likely remain unchanged, although some emergent wetlands may gradually mature to scrub/shrub wetlands and aquatic beds will vary in size depending on yearly reservoir water levels. Even though the Forecast System designation may change on these areas, it would be subject to TVA NEPA review, and any action would be subject to Executive Order No. 11990 (Protection of Wetlands). Executive Order No. 11990 directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

Wetland areas located below the 1020-foot contour elevation, but fronting private land would be reviewed for protection through the Section 26a review process and Executive Order No. 11990 when permits for water-use facilities are requested. Permitted water use facilities would be located to avoid or minimize impacts to these fringe wetlands. Impacts to riparian areas (located on TVA public land) on Norris Reservoir and fronting residential access land would be minimized by requiring a 50-foot-deep Shoreline Management Zone (SMZ) be maintained consistent with TVA SMP standards, effective November 1, 1999 (see Section 1.2). These SMZ areas would be left undisturbed to protect water quality, minimize shoreline erosion, and provide habitat and food for plants and animals. Because of the review mechanisms that are in place to look at any action that might impact wetland and riparian

areas on Norris Reservoir, selection of Alternative A would have insignificant or no impacts on either of these resources.

Alternative B—Under Alternative B, significant wetland areas (excluding Zone 7, Residential Access areas) would be allocated to Zone 3, Sensitive Resource Management or Zone 4, Natural Resource Conservation (Table 3-5). Parcels allocated to Zones 3 and 4 are candidates to be part of TVA’s unit planning process. During unit planning, management strategies to preserve and enhance the value of these wetland resources will be developed. Wetlands would be managed to protect and/or enhance the hydrology, soils, and vegetation of each wetland system. Any impacts to wetlands fronting Residential Access areas (Zone 7) would be avoided or minimized through the Section 26a review process and Executive Order No. 11990 if backlying property owners requested a permit for water use facilities. In addition, all Zone 7 shoreline would be subject to shoreline categorization under the SMP. All wetlands would be placed in either the Shoreline Protection or Residential Mitigation categories, with most wetland areas in the mitigation category. In reviewing plans for permits, TVA will relocate facilities or take other action to avoid impacts. If avoidance is not possible requests may be denied or special mitigation measures may be required. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on wetland and riparian ecology.

TABLE 3-5 RESERVOIR FRINGE WETLANDS		
Zone	Miles of Reservoir Fringe Wetland Areas Influencing Norris Reservoir Shoreline/Zone	Percent of Total Shoreline
1	34.4	4.2
2	0.5	0.1
3	13.9	1.7
4	46.2	5.7
6	13.3	1.6
7	27.3	3.4
Total	135.6	16.7

Riparian communities would be managed to allow the natural development of native vegetation or restored through bioengineering where shoreline erosion is occurring. A minimum 50-foot-deep riparian SMZ would be maintained on all Zones 3 and 4 land, and a minimum 50-foot-deep SMZ would be maintained on all Zone 7 TVA owned land consistent with TVA SMP guidelines effective November 1, 1999. These SMZ areas would be left relatively undisturbed to protect water quality, minimize shoreline erosion, and provide habitat and food for plants and animals.

Selection of Alternative B would provide a beneficial effect to wetland and riparian resources placed in Zones 3 and 4 and future permit reviews would ensure that any impacts to Zone 7 wetlands and riparian areas would be insignificant.

3.6 Recreation

3.6.1 Affected Environment

Norris Reservoir is bordered by Anderson, Campbell, Claiborne, Union, and Grainger Counties. Many people living in these counties find Norris Reservoir an attractive day trip and weekend destination. Norris Reservoir has also recently been discovered by out-of-state residents, especially travelers along the north and south I-75 corridor. Increases in new housing construction and requests to expand marina facilities are the result of this new population of Norris Reservoir users as well as the growing population of native county residents.

As of 1994 only 13.2 percent of the shoreline was developed (TVA, 1998). From the survey and public meetings conducted during the scoping portion of the plan, the public expressed an interest in controlling and managing development on the shoreline of Norris. Such values as “scenic beauty of the shoreline and hills around the reservoir,” “lack of development along the shoreline,” and “wildlife” were consistently identified as reason why people were attracted to Norris.

Only 2 percent (17 miles) of the shoreline was developed for recreation as of 1994. This development included marinas, public parks, and public boat ramps. There are three state parks, two county parks, twelve paved public ramps, and TVA’s Loyston Point Recreation Area (Loyston) providing public access and facilities. Developed campsites are available at two state parks one county park, and Loyston.

Of the 24 approved marinas 23 have been developed. Developed campsites are available at 14 of the marinas and two commercial campgrounds. The marinas provide mooring for approximately 3,500 boats and 1,200 houseboats. The marinas are fairly well dispersed around the reservoir although the majority are located along the northern portion of the reservoir. Two are in Cove Creek, two in Big Creek, four on the lower Clinch, four on the lower Powell, one in Davis Creek, four on the upper Powell, and seven on the upper Clinch.

Informal and dispersed recreation activities, such as primitive camping, bank fishing, hunting, and wildlife observation, occur on the 23,775.8 acres allocated to Sensitive Resource Management and Natural Resource Conservation. Most of these acres are accessed by dirt and gravel roads; however, approximately 1,000 acres of islands are accessible only by boat. Many of the islands are treasured camping spots during the summer months.

There are 4 ski slalom courses on Norris as well as several large parcels allocated for group camps, including Boy Scouts and Girl Scouts. In addition to the reservoir recreation activities, Norris Dam Reservation has many paved parking lots, picnic tables, river access points, and trails. Literally, tens of thousands of people use these facilities each year to gain access to the Clinch Tailwater, which is one of only six TVA tailwaters stocked with trout in the state of Tennessee. In addition, Norris Dam Reservation support facilities are used to gain access to the city of Norris’ watershed trail system which has become very popular with mountain bikers and horseback riders.

Recreation Trends

The Outdoor Recreation Resources Review Commission of 1962 documented that the proximity to water was the most important factor when people chose an outdoor recreation setting. Cordell (1998) identified power boating, water skiing, fishing, and camping as some of those recreation activities that have continued to grow in popularity since 1960.

Results from the questionnaire used during the scoping portion of the Norris Reservoir planning process (See Appendix A-2) indicated that six of the eight most popular activities are water-oriented: fishing, pleasure boating, use of marinas, swimming in undesignated areas, use of public boat ramps, and water skiing.

Although TWRA reports the total fishing pressure on Norris Reservoir decreased 10 percent between 1988 and 1998 (declining from 298,000 hours to 267,000 hours), the total popularity of water-based recreation will continue strong into the future. This is based on national trends and the fact that boating registration has increased in Tennessee at an average rate of 15 percent per year from 1962 through 1998. This is a considerably faster rate of increase than the population rate increase during the same period. A final localized indicator of the continued increase in boating popularity is the fact that many Norris marinas have expanded and improved their facilities during the last four to five years.

Although hunting is on a national decline (Cordell, 1998) and TWRA reports a 14 percent decline in big game hunting since 1988 (TWRA, 1999), the undeveloped land surrounding Norris Reservoir is still important. Cordell (1998) reports an increased participation rate in mountain biking and primitive camping on a national level. Also TVA's scoping efforts indicate the users of Norris Reservoir find value in the undeveloped shoreline as it provides the type of environment they want when participating in water-based recreation activities.

It is anticipated that the demand for local outdoor recreation opportunities, particularly water-based, will continue for the duration of this Plan. It is assumed the minimum increase in demand will be 8.6 percent, which is the projected increase in population from 1999-2010.

3.6.2 Environmental Consequences

Alternative A—Under Alternative A, a large portion of TVA's retained land is forecast for public and commercial recreation, 18,050.4 acres and 97.3 acres respectively. Under the Forecast System, this land could be used indefinitely for informal recreation activities, such as primitive camping, bank fishing, and hunting. However, this same land is subject to requests for developed recreation activities by other public agencies and private depending on the recreation and tourism demand.

Although any requests for recreation development would be subject to environmental review which could result in avoidance and/or mitigation of potential impacts to wetlands, threatened and endangered species, cultural resources, floodplains and other elements of concern, there is a much greater potential for recreational development to occur under the Forecast System than under Alternative B.

Alternative B—Under this alternative 247 acres of additional land are proposed for Zone 6, Recreation. This is in addition to the 1,496.9 acres of committed land that was allocated to Zone 6 due to commitments that were made during the last 60 years. The acreage committed includes the state parks, county parks, marinas, and TWRA access sites.

Under Alternative B, 16,404 fewer acres are subject to developed recreation proposals than under Alternative A. This decrease is, however, in alignment with public desires expressed during scoping. The 247 additional acres allocated to Zone 6 under this alternative are allocated as either expansions of existing public camping and day use areas or new public camping or day use areas. An additional 105 acres were added to Parcel 307 to expand the existing facilities at Loyston. An additional four acres was added to Parcel 159, to develop a boat ramp along the left bank of the Powell River arm. Approximately 138 acres, were added to Parcels 176 and 188 to provide a new day use area and/or campground supporting the upper arm of the Clinch River.

No additional land is allocated in Zone 6 for new commercial recreation development, but some land was allocated for expansion of mooring rights at existing marinas, where the appropriate rights exist. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on recreation.

Conclusion—From a dispersed recreation perspective, there is little practical difference between the two alternatives. Much of the land categorized as Public Recreation, Reservoir Operations, and Steam Plant Study Area under Alternative A is allocated to Natural Resource Conservation (Zone 4) and Sensitive Resource Management (Zone 3) under Alternative B. Recreation activities, such as primitive camping, hunting, bank fishing, bicycle riding, and horseback riding occurring today under the category Public Recreation can also occur under these two zones

Under both alternatives there is some potential loss of informal recreation opportunities because sensitive resources have been identified where some fairly intensive informal recreation is taking place. In general, the desires for more wildlife observation, hiking, bank fishing, hunting, bicycle riding, nature photography, and primitive camping could be met through the proposed Norris Plan or the existing Forecast System. However, there is the potential for informal recreation activities to receive better management through the Unit Planning Process which would provide a long-term resource management strategy specifically for Zone 3 and Zone 4 land. Unit plans are not prepared under Alternative A.

Neither the scoping nor public meetings identified a need or desire for a new major recreation development located on TVA public land. However, there was some expression of additional recreation facility needs not being met by the present level and type of recreation development on Norris. The 247 acres of uncommitted land allocated to Zone 6 in Alternative B are proposed to help meet this need.. The type of facilities proposed for this additional recreational acreage could help alleviate some of the expressed public need for additional picnicking, swimming in designated areas, camping in developed areas, and boat ramp boating opportunities.

In summary, recreation needs of the Norris stakeholder can be met under either land allocation system equally well. However, under Alternative B TVA would not have to consider commercial recreation proposals made on land not allocated to Zone 6.

3.7 Water Quality

3.7.1 Affected Environment

Watershed Description

The Clinch River watershed above Norris Dam encompasses 2,912 square miles in the Ridge and Valley Physiographic Provinces in southwest Virginia and northeast Tennessee. The area is relatively lightly populated. Norris Reservoir is the major reservoir in the watershed (Melton Hill Reservoir lies downstream of Norris). Runoff to Norris Reservoir from the watershed is essentially free flowing, with an average annual discharge of about 4,300 cubic feet per second (cfs); the Clinch and Powell Rivers contribute about 80 percent of this flow (TVA, 1999b). Approximate land use in the Clinch River watershed is 54 percent forest, 28 percent pasture, 10 percent water, 7 percent cropland, and 1 percent urban areas.

Hydrologic Units—Hydrologic Unit Codes (HUCs) are assigned by the U.S. Geological Survey to watersheds ranging in size from the two-digit region codes to the smaller eight-digit cataloging units. The Norris Reservoir watershed is divided into two cataloging units that denote the Clinch and Powell Rivers. The following table (Table 3-6) lists the 11 hydrologic units comprising the Norris Reservoir watershed, according to their unique identifying number and corresponding name, and indicates the assigned rating for each HUC .

HUC	Name	Rating
TN-06010205-190	Clinch River (Upper Clinch Arm)	Good
TN-06010205-200	Indian Creek	Fair
TN-06010205-210	Sycamore Creek	Fair
TN-06010205-220	Clinch River (Lower Clinch Arm)	Fair
TN-06010205-230	Big Creek	Poor
TN-06010205-240	Cove Creek	Fair
TN-06010206-060	Powell River (Powell Valley East)	Fair
TN-06010206-080	Russell Creek	Fair
TN-06010206-090	Powell River (Upper Powell Arm)	Good
TN-06010206-100	Powell River (Lower Powell Arm)	Good
TN-06010206-110	Davis Creek	Poor

The 11 HUCs or watersheds that drain into Norris Reservoir have been rated as being in good, fair, or poor ecological condition. Ratings are based on the professional judgment of

TVA public land and water resource specialists after consideration of Index of Biotic Integrity (IBI) sampling results, condition of aquatic habitats in the watersheds, and land uses. Although both systems use three levels of designation, HUC ratings (i.e., good, fair, or poor) are not directly comparable to state water quality designations which identify streams as either impaired, partially impaired, or unimpaired for various use categories. Three of the 11 HUCs listed in Table 3-6 were rated as “good,” six rated as “fair,” and the remaining two were “poor.”

TVA watershed initiatives that are based on conditions of watersheds using input from stakeholders, coalitions, local governments, and state and federal agencies. Initiatives are undertaken to maintain and improve stewardship practices, land and water quality, biological health and diversity, recreation opportunities, use of BMPs, and establishment of riparian and ecological corridors linking landscape features and inhabitants.

Climatology

Mean annual precipitation in the Clinch River watershed ranges from 42.4 inches to 51.3 inches. Mean monthly precipitation is relatively constant with a tendency toward maximum rainfall in March and minimum rainfall in October (TVA, 1979). The mean annual air temperature at the National Weather Service Cooperative station in Tazewell, Claiborne County, Tennessee, is 54.1 Degrees Fahrenheit (°F). Mean monthly temperatures range from 32.7°F in January to 74.1°F in July.

General Water Quality Characteristics

Like other deep storage impoundments with long retention times, Norris Reservoir exhibits strong vertical density/temperature stratification during summer months. As a consequence, oxygen in the cold, bottom layer is gradually depleted by natural decomposition processes. To remedy this dissolved oxygen (DO) problem in the tailwater (the water in the Clinch River below the dam), Norris was the first dam to benefit from the TVA Reservoir Releases Improvement Program. Routine, seasonal use of hub baffles and turbine venting was employed from 1983 to 1995. In September 1995, a newly designed autoventing turbine runner, which more efficiently aerates discharge water, replaced one of the two original turbine runners. Minimum flows (200 cfs) are provided in the Clinch River below Norris Dam by a reregulating weir constructed in 1984 (TVA, 1996).

Recent TVA Water Quality Monitoring and Results

TVA’s reservoir (and stream) monitoring programs were combined with fish tissue and bacteriological studies in 1990 to form an integrated Vital Signs Monitoring Program to systematically monitor reservoir ecological conditions. Vital signs monitoring activities focus on:

- Physical/chemical characteristics of water
- Physical/chemical characteristics of sediment
- Benthic macroinvertebrate community sampling
- Fish assemblage sampling

Because the confluence of the Clinch and Powell River arms is relatively close to the dam, three Norris Reservoir sampling sites are included in the monitoring program: one forebay site at CRM 80.4, and mid-reservoir sites at CRM 125.0 and Powell River mile (PRM) 30.0 (TVA, 1999b). The Vital Signs Monitoring rating of the overall ecological condition of Norris Reservoir was “fair” in 1999 (near the “good” range); similar results have been seen in previous years. The most consistent problem is low DO levels in the lower half of the water column during late summer and early autumn at all three sites. Water quality ratings from vital signs monitoring data are shown in Table 3-7 (TVA, 1997; TVA, 2000).

Algae are the base of the aquatic food chain. Without algae converting sunlight energy, carbon dioxide, and nutrients into oxygen and new plant material, a reservoir could not support other aquatic life; consequently, measuring algal biomass or primary productivity (i.e., chlorophyll levels) is important in evaluating ecological health. Chlorophyll ratings are based on sampling results compared to what would be considered the “natural” nutrient level in a watershed (i.e., nutrient levels would be expected to be lower in a reservoir in a nutrient-poor watershed than in a more fertile watershed). Norris Reservoir sampling indicates acceptable nutrient levels at all sampling sites (TVA, 2000).

Contaminated bottom sediments can directly impact benthic (i.e., bottom) fauna and can be long-term sources of toxic substances that enter the aquatic environment. Subsequently, contaminants may impact wildlife and humans through the consumption of contaminated food or water or through direct contact. Sampling of Norris Reservoir sediments indicates poor to fair sediment quality at the forebay (area of the reservoir nearest the dam) due to elevated levels of lead and arsenic. Sediment at the Powell River mid-reservoir site which rated poor in 1997, due to elevated levels of lead and nickel, returned to the good ratings seen in previous years with 1999 concentrations being within suggested criteria. Sediment at the Clinch River mid-reservoir site rated good in 1999 (TVA, 2000).

TABLE 3-7 NORRIS RESERVOIR WATER QUALITY RATINGS, BASED ON VITAL SIGNS MONITORING PROGRAM DATA						
Location & Elements Monitored	Monitoring years (no samples taken in 1996 or 1998)					
	1992	1993	1994	1995	1997	1999
Forebay - (CRM 80.4)						
DO	Fair	Poor	Poor	Poor	Poor	Poor
Chlorophyll	Fair	Fair	Fair	Good	Good	Good
Sediment	Fair	Fair	Fair	Fair	Fair	Poor
Clinch Mid-Reservoir - (CRM 125.0)						
DO	Poor	Poor	Poor	Poor	Poor	Poor
Chlorophyll	Good	Good	Fair	Good	Good	Good
Sediment	Good	Fair	Good	Good	Good	Good
Powell Mid-Reservoir - (PRM 30.0)						
DO	Poor	Poor	Poor	Poor	Poor	Poor
Chlorophyll	Good	Good	Good	Good	Good	Good
Sediment	Good	Fair	Fair	Fair	Poor	Good

There are no swimming advisories for Norris Reservoir. TVA monitored fecal coliform bacteria levels at three swimming beaches in 1998. Samples taken at Loyston and Big Ridge State Park were well within state of Tennessee guidelines for water contact. One of the 10 samples collected at Anderson County Park contained high levels of fecal coliform bacteria in a sample collected shortly after a rainstorm.

Recent Evaluations by the State of Tennessee

The 1998 TDEC water quality assessment report, known as the 305(b) Report, listed Norris Reservoir as fully supporting designated stream use classifications. Section 303 of the federal Clean Water Act directs all states to compile a list of the streams and lakes requiring additional pollution controls in order to meet water quality standards. The state 303(d) list was established as part of the Total Maximum Daily Load (TMDL) Program, a state program seeking to restore pollution impacted waters to a condition that meets criteria for the designated uses of the water body. TDEC's priority TMDL streams are Davis Creek, Big Creek, and Russell Creek. Davis Creek is impaired by pathogens, nutrients and siltation. The major source is from a confined animal feeding operation. Big Creek is impaired by pathogens and nutrients stemming from sewer overflows. Russell Creek is impaired by nutrients and siltation from urban runoff and storm sewers (TDEC, 1998).

3.7.2 Environmental Consequences

Alternative A—Under the No Alternative, relatively few parcels are designated specifically for sensitive and natural resource management. Although protection of the natural reservoir shoreline may be undertaken as a secondary consideration on land designated for other uses (Zones 2,5,6 & 7), the resulting impacts on reservoir water quality may not be a primary consideration when land use decisions are made.

The extent to which land uses under the existing Forecast System might affect water quality depends on the nature and extent of development. Under this alternative, future land use and development is less restricted. Additional residential, industrial, and recreational developments on either TVA or private property have the potential to result in some degree of increased soil erosion due to clearing of woody vegetation and brush, increased runoff of agricultural/lawn chemicals, increased sewage/septic loading, and an increase in currently unknown contaminants if additional point source permits are issued on the reservoir. Negative impacts to water quality associated with these activities include increased turbidity, increased levels of substances toxic to aquatic life, increased bacteriological content, and further increases in nutrient loading, which is already occurring in the reservoir.

Use of vegetated buffer zones and other BMPs would minimize some damaging effects of riparian vegetation removal associated with development. In addition, protective measures presently in place under TVA's permitting process, and included in TVA's SMP, will substantially offset impacts of private property development. New facilities with permitted discharges would be required to meet National Pollutant Discharge Elimination System (NPDES) permit limits as well as possible future TMDL limits.

Alternative B—The proposed Norris Plan would protect water quality by allocating some land with more general designations to Sensitive Resource Management or Natural Resource Conservation (Zones 3 and 4, respectively). Any of the proposed uses of Zone 3 or 4 land would promote improved water quality either due to reduced development opportunity or ensured use of management practices to minimize negative impacts. Allocation of other parcels to Zone 6 for future developed recreation activities or other public access/use areas would allow TVA control over development to minimize adverse impacts.

Shoreline development will increase under either alternative. These additional developments have the potential to result in some degree of increased soil erosion due to clearing of woody vegetation and brush, increased runoff of agricultural/lawn chemicals, increased sewage/septic loading, and an increase in currently unknown contaminants if point source discharge permits are issued on the reservoir. Negative impacts to water quality associated with these activities include increased turbidity, increased levels of substances toxic to aquatic life, increased bacteriological content, and a further increase in nutrient loading which is already occurring in the reservoir. TVA's SMI EIS (described in Section 1.2) assessed these anticipated effects and resulted in the adoption of shoreline protection measures to establish standards that minimize these effects.

While water quality impacts resulting from uses of TVA public land would be minimized under either alternative with proper controls, Alternative B limits additional recreation-based development, does not allocate any land for Industrial/Commercial Development (Zone 5), and ensures that other activities, such as timber harvesting, or other conservation uses would be conducted with protection of natural resources as an objective. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on water quality.

3.8 Aquatic Ecology

3.8.1 Affected Environment

Aquatic habitat in the littoral (near shore) zone is greatly influenced by underwater topography and backlying land use. Underwater topography at Norris Reservoir varies from moderately steep, with extensive areas of exposed bedrock near the river channel, to typically shallower in embayments, coves, and areas further from the river channel and tributary stream channels, particularly in upper reservoir reaches. Rock is an important constituent of littoral aquatic habitat over much of the reservoir, either in the form of bedrock outcrops or a mixture of rubble and cobble on steeper shorelines or gravel along shallower shorelines. Most of the soil exposed in the drawdown zone is clay. Numerous islands are present throughout the reservoir. Undeveloped shoreline is mostly wooded, so fallen trees and brush provide woody cover in those areas. Woody habitat is usually reduced on TVA and non-TVA public land where backlying property is largely residential or agricultural. In areas characterized by residential development, habitat includes man-made features, such as shoreline stabilization structures (e.g., riprap) and docks; fallen trees are less numerous in residential areas.

In January 1997, a survey was conducted on Norris Reservoir by TVA to arrive at a Shoreline Aquatic Habitat Index (SAHI) score which would indicate the quality of aquatic habitat conditions in near shore areas. Shoreline conditions were evaluated by moving along the shoreline in a boat during winter drawdown and recording observed conditions. Scoring parameters (metrics) included four physical habitat parameters (i.e., cover/habitat, substrate/gradient, riparian zone/canopy, and bank stability) important to Tennessee Valley reservoir resident sport fish populations which rely heavily on shoreline areas for reproductive success, juvenile development, and/or adult feeding. Individual parameters were scored by comparing observed conditions with “reference” conditions and then assigned a corresponding value of good=5, fair=3, or poor=1. The scores for each metric were summed to obtain the SAHI value. The range of potential SAHI values (4-20) were divided into thirds to provide some descriptor of habitat quality (good=16-20; fair=10-15; and poor=4-9). The overall average SAHI score at Norris Reservoir was 13.3 (of a possible 20), which indicates generally “fair” shoreline aquatic habitat within the reservoir. Of the shoreline distance surveyed, 21 percent rated “good,” 74 percent rated “fair,” and 5 percent rated “poor.”

Benthic Community—Benthic macroinvertebrate (e.g., lake bottom dwelling, readily visible aquatic worms, snails, crayfish, and mussels) samples were taken in three areas of Norris Reservoir in 1994, 1995, 1997, and 1999 as part of TVA’s Reservoir Vital Signs Monitoring Program. Areas sampled included the forebay (area of the reservoir nearest the dam) at CRM 80.4, and mid-reservoir transition stations at CRM 125.0 and PRM 30.0. Bottom dwellers are included in aquatic monitoring programs because of their importance to the aquatic food chain and because they have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Sampling and data analyses were based on seven parameters (eight parameters prior to 1995) that indicate species diversity, abundance of selected species that are indicative of good (and poor) water quality, total abundance of all species except those indicative of poor water quality, and proportion of samples with no organisms present. Collection methods and rating criteria were different prior to 1994, so those results are not compared directly to samples taken using current methods.

As shown in Table 3-8, the benthic community in the three areas of Norris Reservoir rated from poor to excellent at various times in comparison to other Ridge and Valley ecoregion reservoirs. The poor rating in 1999 samples from the forebay is largely a result of low density of benthos, which were comprised primarily of tolerant oligochaetes. The condition of the forebay benthic community also reflects the low DO levels consistently found there (TVA, 2000).

TABLE 3-8 NORRIS RESERVOIR BENTHIC COMMUNITY RATINGS, BASED ON VITAL SIGNS MONITORING DATA				
Station	Monitoring Years			
	1994	1995	1997	1999
Forebay (CRM 80.4)	Fair	Fair	Good	Poor
Mid-reservoir Clinch River (CRM 125.0)	Good	Fair	Fair	Fair
Mid-reservoir Powell River (PRM 30.0)	Excellent	Fair	Good	Excellent

Fish Community—The Reservoir Vital Signs Monitoring Program included annual fish sampling at Norris Reservoir from 1990 through 1995, 1997, and 1999 (no samples were taken in 1996 or 1998). The electrofishing and gill netting sampling stations correspond to those described for benthic sampling. Fish are included in aquatic monitoring programs because they are important to the aquatic food chain and because they have a long life cycle which allows them to reflect conditions over time. Fish are also important to the public for aesthetic, recreational, and commercial reasons. Monitoring results for each sampling station are analyzed to arrive at a Reservoir Fish Assemblage Index ratings which are based primarily on fish community structure and function. Also considered in the rating is the percentage of the sample represented by omnivores and insectivores, overall number of fish collected, and the occurrence of fish with anomalies, such as diseases, lesions, parasites, deformities (TVA, 1999b).

The vital signs fish community monitoring results are shown in Table 3-9. This data compares Norris Reservoir to other Ridge-and-Valley ecoregion reservoirs. Overall results indicate that the Norris Reservoir fish assemblage has scored consistently higher at the two mid-reservoir stations than at the forebay. In TVA’s most recent fish collections at Norris Reservoir in the fall of 1999 the fish assemblage rated “excellent” at both mid-reservoir stations due to very good species diversity and composition, and very low incidence of anomalies. Similar results were not seen at the forebay, where lower-than-expected catch rate and species diversity resulted in a lower score. Thirty-one fish species were collected. More abundant species in the overall sample were gizzard shad, spotfin shiner, bluegill, spotted and largemouth bass, and black crappie (TVA, 2000).

Station	Monitoring Years							
	1990	1991	1992	1993	1994	1995	1997	1999
Forebay (CRM 80.4)	Fair	Fair	Fair	Fair	Good	Poor	Fair	Fair
Mid-Reservoir Clinch River (CRM 125.0)	Good	Fair	Good	Good	Excellent	Fair	Good	Excellent
Mid-Reservoir Powell River (PRM 30.0)	Good	Good	Good	Good	Excellent	Good	Good	Excellent

TWRA 1998 creel data indicate that black bass (i.e., smallmouth, spotted, and largemouth bass), bluegill, striped bass, crappie, and catfish are the most sought after sport fish (TWRA, 1999a). TWRA has conducted annual spring sampling on Norris Reservoir in recent years to monitor growth, mortality, recruitment, and abundance of important sport fish species. Methods were revised in 1999 to select sampling sites that are more representative of the reservoir’s habitat types. Fall 1999 (Table 3-10) sampling found that the percentage of largemouth bass in the black bass sample decreased when compared with previous samples, but this is thought to be a reflection of more accurate sampling rather than an actual decline in largemouth bass densities. The overall age structure of the largemouth bass population is

good, with nine-year classes well distributed in the sample; growth rates were normal compared with previous samples from Norris Reservoir. The sampling of more representative sites in 1999 resulted in a higher percentage of smallmouth bass than seen in past samples.

Norris Reservoir has conditions for supporting a quality smallmouth bass fishery, but has yet to reach its full potential. Smallmouth bass are the most numerous black bass species caught by anglers. Spotted bass were abundant in the sample, but they do not attain quality size. Both angler and sampling surveys have shown that black crappie is the dominant crappie species in Norris Reservoir, with higher populations in the Big Sycamore Creek embayment on the upper Clinch River arm of the reservoir. Data indicate that the walleye fishery is one of the most productive in the reservoir, but is being negatively impacted by their diet rich in alewife which results in early mortality of walleye larvae. Walleye stocking has been implemented in an effort to mitigate mortality losses. Because of the potential for competition between striped bass and other predators for forage, the stocking rate for striped bass has been reduced by 40 percent compared with historic stocking rates (TWRA, 1999b).

TABLE 3-10 FISH SPECIES COLLECTED DURING NORRIS RESERVOIR VITAL SIGNS MONITORING, FALL 1999			
Species	Forebay (CRM 80.4)	Mid-Reservoir Clinch River (CRM 125.0)	Mid-Reservoir Powell River (PRM 30.0)
Longnose gar	-	X	X
Gizzard shad	X	X	X
Common carp	X	X	X
Spotfin shiner	X	X	X
Quillback carpsucker	-	X	X
Northern hog sucker	-	X	X
Silver redhorse	-	X	X
Shorthead redhorse	-	X	X
River redhorse	-	X	X
Black redhorse	-	X	X
Golden redhorse	-	X	X
Channel catfish	X	X	X
Flathead catfish	X	X	X
Brook silverside	X	X	-
White bass	-	-	X
Striped bass	X	X	-
Rock bass	X	X	-
Green sunfish	-	X	-
Warmouth	-	-	X
Bluegill	X	X	X
Redear sunfish	-	X	-
Longear sunfish	X	-	-
Smallmouth bass	X	X	X

TABLE 3-10 FISH SPECIES COLLECTED DURING NORRIS RESERVOIR VITAL SIGNS MONITORING, FALL 1999			
Species	Forebay (CRM 80.4)	Mid-Reservoir Clinch River (CRM 125.0)	Mid-Reservoir Powell River (PRM 30.0)
Spotted bass	X	X	X
Largemouth bass	X	X	X
Black crappie	-	X	X
Sauger	-	X	X
Walleye	X	X	X
Logperch	-	X	X
Tangerine darter	-	-	X
Freshwater drum	X	X	X

A Sport Fishing Index (SFI) has been developed to measure sport fishing quality for various species in Tennessee and Cumberland Valley reservoirs (Hickman, 1999). The SFI is based on the results of fish population sampling by TVA and state resource agencies and results of angler success as measured by state resource agencies (i.e., bass tournament results and creel surveys). In 1998 Norris Reservoir rated better than average for smallmouth, spotted, and striped bass. The SFI rating was below average for black bass species as a group, largemouth bass, crappie, walleye/sauger, and channel catfish.

There are no fish consumption advisories in effect for Norris Reservoir. TVA last collected channel catfish and largemouth bass for tissue analysis in the of autumn 1997. All contaminant levels were either below detection levels or below the levels used by the state to issue fish consumption advisories.

3.8.2 Environmental Consequences

Impacts to aquatic resources are directly related to changes of the existing natural shoreline conditions. Aquatic resources can be impacted by changes to shoreline (riparian) vegetation, vegetation on backlying land, and land uses. Shoreline vegetation (particularly trees) provides shade, organic matter (a food source for benthic macroinvertebrates), and shoreline stabilization; and trees provide aquatic habitat (cover) as they fall into the reservoir. Shoreline vegetation and vegetation on backlying land provide a riparian zone which functions to filter pollutants from surface runoff while stabilizing erodible soils. Therefore, there would likely be some degradation of aquatic habitats associated with continued development along the reservoir shoreline under either alternative.

Preservation of a natural shoreline condition, to the extent possible, on TVA public land is important on Norris Reservoir because such a large percentage of the backlying property is in private ownership, and therefore subject to development. Although much of the private land is presently undeveloped, future development could greatly alter the character of much of the reservoir shoreline. Shoreline development can alter the physical characteristics of adjacent fish and aquatic invertebrate habitats, which can result in dramatic changes in the quality of the fish community. One of the most detrimental effects of shoreline development is the

removal of riparian zone vegetation, particularly trees. Removal of this vegetation can result in loss of fish cover and shade, which elevates surface water temperatures. Also, fish spawning habitat, such as gravel and woody cover, can be rendered unsuitable by excessive siltation and erosion, which can occur when riparian vegetation is cleared (TVA, 1999a). Additionally, shoreline development often results in the removal of existing aquatic habitat (i.e., stumps, brush, logs, boulders) in association with the construction of water use facilities.

Under some circumstances, construction of docks and piers, while having short-term negative impacts, can increase fish habitat. Docks and other water use facilities can provide shade and cover for fish and aquatic invertebrates. Water use facilities, when combined with habitat improvements, such as anchored brush, rock aggregations, log cribs, and/or other forms of cover, can actually enhance the shoreline aquatic habitat.

Alternative A—Under this alternative, few parcels are designated specifically for sensitive resource management and natural resource conservation. Although protection of the natural reservoir shoreline may be undertaken as a secondary consideration on TVA public land designated for various uses, natural resource protection or conservation, and consequently, impacts to aquatic communities, may not be a primary consideration when land use decisions are made affecting those parcels. There could be more recreation and TVA operations development under this alternative. Consequently, more direct and indirect disturbance of aquatic habitat could occur. There could also be greater potential for sedimentation and nutrient runoff.

Alternative B—Adoption of the proposed Norris Plan would provide a better opportunity to protect or enhance aquatic habitats by allocating land to Sensitive Resource Management (Zone 3) Natural Resource Conservation (Zone 4) as the designated use on some parcels now having general designations for other uses. Any of the proposed uses of Zone 3 or 4 land would allow for the protection or enhancement of aquatic habitats by preserving a natural shoreline condition offering a variety of cover types. The extent of woody shoreline cover on such land as is included in Zones 3 and 4 would be expected to increase in the future as natural succession continues. Alternative B allocates 4,839.2 acres (17 percent) of TVA public land on Norris Reservoir to Sensitive Resource Management (Zone 3) and an additional 18,936.6 acres (68 percent) to Natural Resource Conservation (Zone 4).

Even consumptive activities, such as timber harvesting (or other resource manipulation activities) on Zone 4 land would not adversely impact aquatic resources if properly planned and conducted so that the riparian zone and associated littoral aquatic habitats are protected. The littoral area is the most productive region of a reservoir. The more important fish species use littoral habitats because of their spawning requirements, the availability of submerged cover (i.e., rocks, logs, brush), and aquatic invertebrates and small fish as a food source.

Allocation of other parcels for future recreation activities would allow TVA to manage such developments to minimize adverse impacts. Under Alternative B 1,743.9 acres (approximately 6 percent) are allocated to Recreation (Zone 6). Development associated with recreation infrastructures, such as public parks, recreation areas, and water access sites could

allow access for bank fishing and may be suitable for fishing piers, placement of artificial fish attractors, or other habitat enhancements.

Residential development of the reservoir shoreline is likely to continue under either alternative. However, standards implemented in accordance with TVA's SMP (TVA, 1999a) will provide improved protection for existing natural shoreline conditions. Some negative impacts to the aquatic environment would occur under either alternative, but such impacts can be rendered insignificant with proper planning, use of protective and mitigative measures during development and implementation of shoreline categorization. Because aquatic habitat on Norris Reservoir can be considered only "fair" overall, impacts to aquatic habitats would be a major consideration in future decisions affecting TVA public land under either alternative. However, Alternative B is preferred because it better defines suitable activities for each parcel of TVA public land, and would likely result in fewer impacts. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on aquatic ecology.

3.9 Socioeconomic

3.9.1 Affected Environment

Population

The 1999 population of the five counties in the Norris Reservoir area is estimated by the U.S. Bureau of the Census to be 176,020, a 9.8 percent increase over the 1990 population of 160,255 (Tables 3-11 and 3-12). This growth rate is slower than that of the state, which is estimated to have grown by 12.4 percent, but almost the same as the Nation, at 9.6 percent. Union County, located just to the north of Knoxville and part of the Knoxville metropolitan area, had the fastest growth rate at 21.1 percent, followed closely by Grainger County to the east of the Knoxville metropolitan area, at 18.3 percent. Projections suggest that the area is likely to grow more slowly than the state and the Nation over the next 20 years; although Union County is expected to continue to grow faster.

TABLE 3-11 POPULATION AND POPULATION PROJECTIONS, 1980-2020					
County/State/Nation	1980	1990	1999	2010	2020
Anderson	67,346	68,250	71,004	76,000	79,275
Campbell	34,923	35,079	38,466	41,236	43,104
Claiborne	24,595	26,137	29,747	31,968	33,531
Grainger	16,751	17,095	20,219	21,691	23,332
Union	11,707	13,694	16,584	20,216	23,574
County Total	155,322	160,255	176,020	191,111	202,816
State	1980	1990	1999	2010	2020
Tennessee	4,591,023	4,877,203	5,483,535	6,062,695	6,593,194
Nation	1980	1990	1999	2010	2020
United States (000s)	226,542	248,791	272,691	299,862	324,927

Source for table 3-11: Historical data from the U.S. Census Bureau; state and county projections from University of Tennessee, Center for Business and Economic Research, Population Projections for Tennessee Counties and Municipalities, March 1999; U. S. projections are the middle series from the U.S. Census Bureau, Population Division, Population Projections Program.

TABLE 3-12 PERCENT CHANGE IN POPULATION					
County/State/Nation	1980-1990	1990-1999	1999-2010	2010-2020	1980-2020
Anderson	1.3	4.0	7.0	4.3	17.7
Campbell	0.4	9.7	7.2	4.5	23.4
Claiborne	6.3	13.8	7.5	4.9	36.3
Grainger	2.1	18.3	7.3	7.6	39.3
Union	17.0	21.1	21.9	16.6	101.4
County Total	3.2	9.8	8.6	6.1	30.6
Tennessee	6.2	12.4	10.6	8.8	43.6
United States	9.8	9.6	10.0	8.4	43.4

Labor Force and Unemployment

In 1999 the civilian labor force of the area was 84,590, as shown in Table 3-13. Of these, 3,890 were unemployed, for an unemployment rate of 4.6 percent. Unemployment rates varied among the counties from 3.6 percent in both Anderson and Union Counties to 7.7 percent in Campbell County. The overall rate was somewhat higher than the state and national rates, with three of the five counties higher than both the state and the Nation.

TABLE 3-13 LABOR FORCE DATA, RESIDENTS OF NORRIS RESERVOIR AREA, 1999			
County/State/Nation	Civilian Labor Force	Unemployment	Unemployment Rate (%)
Anderson	36,250	1,290	3.6
Campbell	17,040	1,310	7.7
Claiborne	13,210	570	4.3
Grainger	10,210	440	4.3
Union	7,880	280	3.6
County Total	84,590	3,890	4.6
Tennessee	2,818,800	113,500	4.0
United States	139,368,000	5,880,000	4.2

Source: Tennessee Department of Employment Security

Jobs

In 1997 the Norris Reservoir area had over 86,000 jobs, an increase of almost 18 percent over the level in 1989. This represents a faster rate of growth than in the Nation, but a slightly slower rate than the state. Three of the five counties grew faster than the state, while Anderson, the largest of the five, had much slower growth and Campbell slightly slower growth. Over 53 percent of the jobs in 1997 were in Anderson County.

Manufacturing is a larger part of the economy of the Norris Reservoir area counties than in the state or the Nation. Approximately 22.9 percent of jobs in the area are manufacturing, compared to 16.2 percent statewide and 12.4 nationally. Manufacturing's share of total employment in Campbell County; however, is about the same as in the state, while it is larger than the state in the other four counties, ranging from 20.1 percent in Union County to 27.2 percent in Claiborne County. Nationally, as production has become more efficient and the economy moves more and more to a service economy, manufacturing employment has declined, decreasing by 2.9 percent between 1989 and 1997. The state of Tennessee has been following that trend, but at a slower pace, with a decline of 0.5 percent from 1989 to 1997. Also in line with that trend, the Norris Reservoir area counties had a decrease of 2.0 percent during this same time period. Anderson County had a decline of 10.6 percent, Campbell County had a decline of 8.2 percent; and the other three counties had increases, led by Claiborne County with an increase of 28.3 percent (see Table 3-14).

TABLE 3-14 EMPLOYMENT, NORRIS RESERVOIR AREA			
County/State/Nation	1989	1997	Percent Change
Total Employment			
Anderson	40,465	45,977	13.6
Campbell	11,650	13,834	18.7
Claiborne	11,700	14,217	21.5
Grainger	5,954	7,184	20.7
Union	3,399	4,927	45.0
County Total	73,168	86,139	17.7
Tennessee	2,754,280	3,285,827	19.3
United States (000s)	137,317.7	156,410.4	13.9
Manufacturing			
Anderson	12,102	10,822	- 10.6
Campbell	2,456	2,254	- 8.2
Claiborne	3,017	3,871	28.3
Grainger	1,738	1,802	3.7
Union	827	989	19.6
County Total	20,140	19,738	- 2.0
Tennessee	534,599	531,860	- 0.5
United States (000s)	19,997.6	19,415.8	- 2.9
<i>Note: Includes full- and part-time employment, both wage and salary and proprietors</i>			
<i>Source: U.S. Bureau of Economic Analysis, Regional Economic Information System</i>			

Occupation Patterns

As shown in Table 3-15, the Norris Reservoir area has a smaller proportion of its workers in managerial and professional jobs than the state and national averages. The area also has a smaller proportion of its workers in technical, sales, and administrative support positions. Conversely, it has a higher share of its workers in blue-collar jobs, including the higher paid skill levels. The five counties in the area vary considerably with regard to occupational distribution, with Anderson County having a distribution much more like the national distribution.

TABLE 3-15 OCCUPATION OF WORKERS (PERCENT DISTRIBUTION, 1990)				
Occupation	Anderson	Campbell	Claiborne	Grainger
Managerial and Professional	26.3	15.4	16.3	10.0
Technical, Sales, Administrative	29.8	22.8	20.4	18.0
Service Occupations	12.8	14.0	10.2	10.4
Farming, Forestry, Fishing	1.1	1.8	4.2	5.7
Precision Production, Craft, Repair	14.2	18.7	16.9	17.3
Operators, Fabricators, Laborers	15.9	27.3	32.0	38.5
Occupation	Union	Area Average	Tennessee	U.S.
Managerial and Professional	9.0	19.4	22.6	26.4
Technical, Sales, Administrative	24.3	25.3	30.1	31.7
Service Occupations	8.3	12.0	12.4	13.2
Farming, Forestry, Fishing	3.6	2.4	2.2	2.5
Precision Production, Craft, Repair	18.6	16.2	12.2	11.3
Operators, Fabricators, Laborers	36.2	24.8	20.5	14.9

Source: U.S. Bureau of the Census, Census of Population 1990

Income

Per capita personal income in the Norris Reservoir area increased by 39.8 percent from 1989 to 1997 (see Table 3-16). This was slightly faster than the national growth rate of 39.3 percent, but below the state rate of 47.0 percent. Only Campbell County, at 48.6 percent, exceeded the state growth rate; the slowest growth was in Anderson County, with a growth rate of 35.9 percent.

TABLE 3-16 PER CAPITA PERSONAL INCOME			
County/State/Nation	1989	1997	Percent Change
Anderson County	16,287	22,130	35.9
Campbell County	10,303	15,313	48.6
Claiborne County	10,675	15,587	46.0
Grainger County	10,246	14,941	45.8
Union County	9,466	13,436	41.9
County Total	12,841	17,950	39.8
Tennessee	15,438	22,699	47.0
United States	18,153	25,288	39.3

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Environmental Justice

Table 3-17 shows the minority population in the area at 3.9 percent of the total in 1998. This is well below the state average of 18.7 percent and the national average of 27.7 percent. Minority population is defined as nonwhite persons and white Hispanics (nonwhite Hispanics are already included in the nonwhite estimate and are not counted again as Hispanic). None of the five counties has a minority population share close to the state and national averages, with Anderson the highest at 7.1 percent. Overall, the poverty level in the area at 18.0 percent is higher than the state at 14.7 percent and the nation at 13.8 percent. Rates by county vary from a low of 13.0 percent in Anderson County to a high of 23.7 percent in Campbell County.

County/State/ Nation	Population	Minority Population			Poverty
	Total	Nonwhite	White Hispanic	Percent Minority	Percent Below Poverty Level
Anderson	71,116	4,368	660	7.1	13.0
Campbell	38,241	440	219	1.7	23.7
Claiborne	29,529	571	160	2.5	22.6
Grainger	19,829	210	88	1.5	18.4
Union	16,260	70	85	1.0	17.9
County Total	174,975	5,659	1,212	3.9	18.0
Tennessee	5,430,621	964,261	53,718	18.7	14.7
United States	270,298,524	47,297,795	27,561,226	27.7	13.8

Source: Estimates by the U.S. Bureau of the Census

3.9.2 Environmental Consequences

Potential socioeconomic impacts could arise from use of reservoir land for industrial or commercial use and from the construction of water use facilities. Effects may also occur if recreational or visual resources attract people from outside the area. Additional impacts may occur if residential development is attracted to areas on or near the reservoir.

Under both Alternatives A and B, about 1,473 acres would be designated for residential access. These are areas that already have deeded or implied access rights and, therefore, could be used for residential access under each alternative. Generally, these are narrow strips along the reservoir that could provide access for residents on adjacent or backlying properties. Residents of such developments generally would be persons who would otherwise live elsewhere in the area. However, some retirees might be attracted to these developments, especially if planned and marketed for retirees. To the extent that retirees are attracted from outside the area, there would be some increase in population and in local income and spending. Building of water access facilities might also have some positive impact on the local economy.

Alternative A—Under this alternative, the Forecast System would continue to be used. This system currently classifies no land for industrial use, except for some small tracts used for commercial landing purposes. Any proposals for industrial use of these properties would receive appropriate environmental review when specific proposals are presented for TVA approval.

Over 18,000 acres of land are designated for Public Recreation. Most of this is used only for informal, dispersed activities, such as hunting, hiking, fishing, and primitive camping. Most activity of this type is by people who live in the general area, close enough that visits do not require overnight accommodations. However, there is and would continue to be some outside usage. Outside usage has a positive impact on income and employment in the area; however, this impact is not likely to be an important component of income in the area. In addition to informal recreation, these properties, with TVA approval, could also be developed for more formal activities, such as parks, boat launching areas, and campgrounds. Also, about 97 acres are classified as Commercial Recreation allowing for more developed and intensive use, such as commercial marinas and campgrounds. Much of the use of these more developed areas also would be local in nature, but some users would be from outside the area, and their spending would have a small, but positive, impact on income in the area.

Some of the remaining land, such as reservoir operations or dam operations could be used for informal recreation purposes, attracting primarily users from the local area and surrounding counties. Such uses would have only small impacts on income and employment in the local area.

Alternative B—Under Alternative B, no land would be classified for industrial/commercial use. Over 1,700 acres would be zoned for Recreation. All of this could be available for development requiring capital expenditures and maintenance. Construction of facilities and use of the property for such purposes would have some positive impact on income and employment in the area. Much of the use, however, depending on the type of development, is likely to be by residents of the local area or adjoining counties, limiting the impact.

Most of the remaining land would be zoned as either Sensitive Resource Management (Zone 3) or Natural Resource Conservation (Zone 4). These areas may be used for informal recreation and such usage would be largely by residents of the local area or surrounding counties. Such activities would have no noticeable impact on the local economy. Protection and good management of such land would, however, enhance the scenic and environmental qualities of the area, thereby improving the quality of life and making the area more attractive to potential residents and visitors. This attraction would have some indirect positive impacts on income and employment in the area. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on socioeconomic conditions.

Environmental Justice

No industrial land was forecast (Alternative A) for Norris Reservoir and none is allocated under Alternative B. Residential development and tourism amongst visitors from outside the

area would positively effect the local economy. None of the five counties in the Norris Reservoir area has a percentage of its minority population close to the state or national averages and overall per capita income of whites and nonwhites has increased comparable to state and national trends. As discussed in Section 3.9.1 and indicated Table 3-17, the number of nonwhites in the population is very small and well below the state and national averages. The low-income population is only slightly higher than the state and national averages.

Although positive, TVA does not expected that the economic effects of either alternative would differ substantially and be small. Because these benefits would be small, no adverse effects on minority or low-income populations are expected. Therefore, the small positive economic benefits generated are not expected to disproportionately negatively affect disadvantaged groups compared to other populations. Any major development project that might occur under either alternative could have positive impacts. However, any such developments that required TVA approval would receive the appropriate level of environmental review, including potential environmental justice effects, before they could be approved.

3.10 Navigation

3.10.1 Affected Environment

There is no commercial navigation on Norris Reservoir; however, the TVA Navigation Program assists in the installation and maintenance of navigation aids on land surrounding the reservoir to assist recreational boaters. There are 25 day markers located at intervals on the Clinch River between Norris Dam (mile 79.8) and CRM 148.3 that provide boaters with information on the river mile locations. In addition, nine daymarks are located at intervals on the Powell River, a tributary which enters the Clinch River at mile 88.6. TVA also assists in marking hazardous boating areas with boat hazard buoys on Norris Reservoir. Maintenance is performed at least once a year to replace missing or damaged navigation aids and boat hazard buoys, and vegetation is removed from the immediate vicinity of the daymarkers to ensure that they are visible to boaters.

3.10.2 Environmental Consequences

Under all alternatives, there would be no significant impact on navigation aids used by recreational boaters. The main concerns are the continued placement of the signs along the shoreline and visibility of the signs. Because navigation aids are located along the shoreline, the construction of water use facilities associated with residential development or marinas would have the potential for impacting navigation aids. Requests for marinas, docks, boathouses, fishing piers, and launching ramps within 50 feet of navigation aids would need to be reviewed by TVA's Navigation Program during the Section 26a process. The Section 26a approval process would ensure that water use facilities constructed along the shoreline would not reduce visibility of the signs or compromise their placement on the shoreline. Commercial developments that do not involve the placement of structures in the reservoir

would have no impact on navigation aids. Alternative B, the TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on navigation

Increased residential and recreational development would likely increase the number of recreational boats and jet skies on the reservoir. TVA, however, has no regulations limiting the numbers of boats that can operate on TVA reservoirs. TWRA is responsible for enforcement of boating safety regulations in the state of Tennessee, including Norris Reservoir.

3.11 Prime Farmland

3.11.1 Affected Environment

Prime farmland may currently be in use as cropland, pastureland, range land, forestland, or other uses, but cannot be urban or built-up land. Land use within a 1-mile buffer strip around the shoreline of Norris Reservoir is approximately 64 percent forestland and 17 percent agricultural land. Only about 1,143 acres (5 percent) of the TVA land on Norris Reservoir is used for agriculture. Few parcels have more than 50 percent of the acreage in agricultural land use.

Prime farmland, as defined by USDA, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The soils which constitute prime farmland must have properties needed for the economic production of sustained high yields of crops. The conversion of farmland and prime farmland soils to industrial and other nonagricultural uses essentially precludes farming the land in the foreseeable future. Creation of the 1981 Federal Farmland Protection Policy Act (FPPA) addressed this possibility and establishes provisions under which federal agencies evaluate land prior to permanently converting it to a nonagriculture land use. The FPPA encourages federal agencies, with assistance from the Natural Resource Conservation Service, to complete Form AD 1006, *Farmland Conversion Impact Rating*, before an action is taken. Soils in the project area classified as prime farmland soils are listed in Table 3-18.

TABLE 3-18 SOILS IN THE NORRIS LAND USE PROJECT AREA CLASSIFIED AS PRIME FARMLAND	
County	Soils
Anderson	Sequatchie and Staser loams; Hamblen and Tasso silt loams
Claiborne	Leadville silt loam; Holston, Philo, Pope, and Sequatchie fine sandy loams
Grainger	Sewanee loam
Union and Campbell	Dewey, Emory, Etowah, Greendale, Lindside, and Ooltewah silt loams; Philo, Pope, and Sequatchie fine sandy loams

The Norris Plan reaches portions of a five-county area and contains 131 different soil mapping units. The Fullerton, Talbot, Clarksville, and Claiborne soil series predominate. The Fullerton, Clarksville, and Claiborne soils were derived from cherty and sandy dolomitic

limestone and are located on slopes and crests of the high ridges around the river valleys. The Talbot soils were derived from limestone residuum and are located on steep and hilly slopes

The prime farmland soils are located on the colluvial sloping fans and benches of the foot slopes of hills or on the floodplains of streams and rivers. Soils classified as prime farmland are loams, silt loams, and fine sandy loams. Emory, Greendale, and Ooltewah soils were derived from materials washed from the uplands underlain by limestone and dolomite. Pope, Philo, and Sequatchie were formed from alluvium chiefly from sandstone and shale materials and Lindsie from chiefly limestone alluvium. Leadvale soil was derived from materials washed from uplands underlain by sandstone and shale with some limestone influence. There are 433.5 acres of prime farmland on TVA land on Norris Reservoir.

3.11.2 Environmental Consequences

As indicated in regulations implementing the FPPA, Form AD 1006, *Farmland Conversion Impact Rating*, may be completed if a site which contains prime farmland soils is larger than 10 acres and is to be permanently converted to a land use that can no longer be used for agriculture. The rating is based on soil characteristics as well as site assessment criteria, such as agriculture and urban infrastructure, support services, farm size, compatibility factors, on-farm investments, and potential farm production loss to the local community and county. Sites receiving 160 total points or greater must be given a higher level of consideration for protection.

Alternative A—Completion of Form AD 1006 assists in evaluating the impacts of farmland conversion for parcels of TVA land containing prime farmland. Under Alternative A, development of TVA land for a steam plant, commercial recreation, or permitted residential uses of mainland reservoir operations lands (totaling about 2,275 acres) would likely result in prime farmland soils conversion. However, because of the small amount of prime farmland in the project area, any of these development associated with these uses would probably result in an impact rating score below the 160 which suggests that protection of farmland be considered.

Alternative B—The majority of the parcels with prime farmland have been allocated for Sensitive Resource Management and Natural Resource Conservation. These parcels would need no further evaluation because land use conversion is unlikely. Depending on the nature of the action, completion of Form AD 1006 could be used to assist in evaluating the impacts of future development on parcels in Zone 6, Recreation. Based on the rating, development impacts on prime farmland in the individual parcels would be minimized. Also, completion of Form AD 1006 would assist in evaluating the impacts on residential access parcels. Within Zone 7, disturbance of the land from excavation and grading could occur. The small amount of prime farmland in any of these parcels would probably result in a low rating.

Most of the land in the project area that is used for agriculture has been allocated for Sensitive Resource Management and Natural Resource Conservation. The total agriculture

land use in all these parcels is approximately 90 acres, and none contain prime farmland soils. The development of these parcels would have an insignificant impact on farmland.

Along with SMP standards on residential access shoreline, independent environmental reviews would be conducted by TVA on projects requiring land use or Section 26a approval. Therefore, the environmental effects on prime farmland are expected to be insignificant under either Alternative A or B.

3.12 Other Issues

3.12.1 Floodplain

Affected Environment

The 100-year floodplain on Norris Reservoir is the area inundated by the 100-year flood. The 100-year flood for the Clinch River varies from elevation 1032 feet above msl at Norris Dam (CRM 79.8) to elevation 1055 feet msl at approximately the upper end of Norris Reservoir (CRM 155.14). For the Powell River, the 100-year flood varies from elevation 1032 feet msl at the mouth to elevation 1068 feet msl at approximately the upper end of Norris Reservoir (PRM 63.28).

Any development proposed in the 100-year floodplain would be subject to the requirements of Executive Order No. 11988 (Floodplain Management). The first step would be to determine if the activity is covered under TVA's "Class Review of Certain Repetitive Actions in the 100-Year Floodplain" (see Memorandum from Mohamed T. El-Ashry to Those listed, August 13, 1981)." The following repetitive actions were reviewed:

- Private and public water use facilities
- Commercial recreation marinas and water use facilities
- Picnic tables, benches, grills, and fences on TVA land
- Underground, overhead, or anchored utility and related lines and support structures
- Water intake structures
- Outfalls
- Mooring and loading facilities for barge terminals
- Agricultural use of TVA land
- Minor grading and fills
- Bridges and culverts for pedestrian, highway, and railroad crossings
- Small, private, land-based storage sheds and buildings having less than 25 square feet of floor space and used for storage of water use-related equipment

As a result of this review, TVA determined that there were no practicable alternatives to several actions that would avoid siting in the floodplain. A set of review criteria was also established to ensure that natural and beneficial floodplain values are not significantly

affected by the repetitive actions. If these criteria are followed, adverse floodplain impacts would be minimized.

If an activity is not a repetitive action in the 100-year floodplain, Executive Order No. 11988 requires the applicant and TVA to evaluate alternatives to the floodplain siting which would either identify a better option or support and document a determination of “no practicable alternative” to siting within the 100-year floodplain. If this determination can be made, adverse floodplain impacts would be minimized.

Any fill material placed between elevations 930- and 1020-foot msl is subject to a charge for lost power storage. Generally, the quantity of fill required for residential projects, such as shoreline stabilization and boat ramps, would not result in a charge for lost power storage. Any material placed between elevations 985-foot msl and the 500-year flood elevation is subject to the requirements of the TVA Flood Control Storage Loss Guideline (TVA, 1999c). All development subject to flood damage must be located above the 500-year flood elevation.

The 500-year or “critical action” floodplain on Norris Reservoir varies from elevation 1035.0-foot msl at Norris Dam (CRM 79.8) to elevation 1058.7-foot msl at approximately the upper end of Norris Reservoir (CRM 155.14). For the Powell River, the 100-year flood varies from elevation 1032-foot msl at the mouth to elevation 1073 feet msl at approximately the upper end of Norris Reservoir (PRM 63.28).

Environmental Consequences

For either Alternative A or B, any development proposed in the 100-year floodplain would be subject to the requirements of Executive Order No. 11988 (Floodplain Management).

Under Alternative A, decisions about development or management of properties would be made on a case-by-case basis, and evaluations would be done individually to ensure compliance with Executive Order No. 11988. Under this alternative, projects such as development of TVA land for a steam plant, commercial recreation, or permitted residential uses of mainland reservoir operations lands would be reviewed for their effects on floodplains. Potential developments of this nature would be planned to avoid, minimize, or mitigate adverse floodplain impacts to minor or insignificant levels.

Under Alternative B, the potential adverse impacts to natural and beneficial floodplain values would be less than those under Alternative A, because a substantial portion of the available land would be allocated for resource management and conservation activities. Little development which could affect floodplain values would occur on these Zones 3 and 4 land (23,695 acres or 85 percent). Less land in Zone 6 would be subject to flooding compared to the amount of land in Zone 7. However, potential development in both these zones would likely be constructed above the flood elevation or consist of boat ramps, dock, and other water use facilities as well as other repetitive actions in the floodplain that would result in minor impacts. If a permissible non-repetitive action is proposed, TVA would ensure Executive Order 11988 compliance as outlined above. Therefore, under Alternative B,

impacts on floodplains would be minimized and under either alternative, impacts to floodplain values would be insignificant.

3.12.2 Noise

Affected Environment

Community noise levels follow the extent of human activities. As activities go up, the community noise increases and to some degree the reverse is also true. There are no federal or state standards for community noise. Many municipal governments have statutes limiting the level of noise that can be emitted within their jurisdictions. The main purpose of statutes is to reduce the disturbance of adjacent residents. In 1974 the U.S. Environmental Protection Agency (USEPA) published community noise guidelines (USEPA, 1974) recommending levels of community noise that should protect the health and welfare of the public. Although the guidelines are not standards, they are frequently used to evaluate the potential effects of intruding community noise from new sources. Other approaches to evaluating the potential effects of intruding community noise are also used. These include modeling the intruding noise and comparing it to the current or background level of community noise or using local covenants, such as those found in zoning laws.

These methods of evaluating community noise effects depend on knowing the new sources of noise. This EA does not address specific, new noise emitting sources so the traditional, previously presented methods of evaluating the potential effects of community noise changes are not applicable. Potential community noise effects will be evaluated for this EA on two levels. The first level will be a comparison of the likely effects based on the change in land allocations from Alternative A to B. In general, the amount of land allocated to each zone or land use designations would be a measure of the potential noise effects from the land uses. The second level is a review conducted in the future to evaluate each land use request to determine its potential for causing community noise effects. The land allocation summaries for Alternatives A and B are found in Table 2-7.

Environmental Consequences

Alternative A—The Forecast System land designations within which development of specific, new noise sources might occur are the Reservoir Operations - Mainland (approximately 1,327 acres), Commercial Recreation (approximately 97 acres), and Industrial and Minor Commercial Landings (approximately 24 acres). Reservoir Operations land includes residential development; Commercial Recreation covers marinas; and Industrial and Commercial Landings comprise a range of potential manufacturing and processing operations, as well as barge loading and servicing facilities.

Noise from single-family residences usually comes from recreational (boating and personal watercraft), landscaping, and transportation sources. These are common noises currently found around the reservoir. The level of these noises depends on the density of residences in an area. Multi-family residences, such as condominiums, would generate the same type of noises but at higher levels in the local area. This alternative has approximately 1,483 acres

available for residential access. Large developments of single-family or multi-family housing would likely have the second level of community noise evaluation.

Possible development of marinas and campgrounds on the Commercial Recreation land would increase, to some extent, the levels of recreational and transportation noise generated in the respective areas. All of these possible developments would have the second level of community noise evaluation. The relatively small amount of land designated in this allocation, 97 acres, limits the size and number of potential new facilities.

Industrial and Commercial Landing operations could generate noise from a very wide array of operations, such as metal pressing, log debarking, and barge transloading that are very noisy. Sometimes the operations are in buildings, which is usually the case for metal pressing, but other times the operations are outside, which is usually the case for log debarking. All requests for Industrial and Commercial Landing Development would go through the second level of community noise evaluation. The land designated for this zone, about 24 acres, is too small for the development of medium- or large-size operations.

Alternative B—The allocation of committed land in this alternative is different from Alternative A. with the exception of residential development (approximately 1,472.55 acres) which will not vary between the two alternatives.

A broader land use zone designated Recreation in Alternative B includes the Commercial Recreation of Alternative A as well as the other recreational uses given in Table 2-4. Approximately 1,743.9 acres are allocated to Zone 6 in Alternative B. It should be noted that 73 percent of the land allocated to Recreation (Zone 6) has already been developed or previously designated for a developed recreation use. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on noise.

Alternative B has about a 92 percent decrease in available land for Commercial Recreation and a 100 percent reduction (going from 97 acres to 0 acres) in land for Industrial and Commercial Development. The impacts of noise from increases in residential dwellings would be equal between the two alternatives.

Alternative B is preferred because it allocates less land to developed recreation uses and does not allocate any land to industrial/commercial uses. This will reduce the level of community noise from those levels anticipated that could be present with Alternative A. There would be no significant noise impacts associated with Alternative B.

3.12.3 Air Quality

Affected Environment

National Ambient Air Quality Standards establish safe concentration limits in the outside air for six pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. These standards are designed to protect public health and welfare. An

area where any air quality standard is violated is designated as a nonattainment area for that pollutant, and emissions of that pollutant from new or expanding sources are carefully controlled. Knox County, Tennessee, which is only a few miles to the south from the southernmost parts of Norris Reservoir, had been a nonattainment area for ozone but has achieved attainment of the one-hour ozone standard and currently is in maintenance status for that pollutant. In July 1997 USEPA promulgated new, more restrictive standards for ozone and particulate matter. These new standards upon being challenged, was amended by the U.S. Supreme Court for further analysis and review.

In addition, Prevention of Significant Deterioration (PSD) regulations protect national parks and wilderness areas that are designated PSD Class I air quality areas. A new or expanding major air pollutant source is required to estimate potential impact of its emissions on the air quality of any nearby Class I area, as specified by the state or local air regulatory agency, with input from the federal Land Manager(s) having jurisdiction over the given Class I area(s). Of the two PSD Class I areas within 62 miles of Norris Reservoir, the closest is the Great Smoky Mountains National Park, approximately 38 miles to the southeast at the nearest point. The other, in North Carolina, is Joyce Kilmer/Slickrock National Wilderness Area, approximately 53 miles to the south at the nearest point.

Environmental Consequences

The Norris Plan is designed to minimize direct and indirect, and cumulative air emissions impacts resulting from any TVA allocation decisions. Pollution from fossil-fuel combustion in construction equipment, fugitive dust emissions from operation of this equipment during dry conditions, and increased traffic during construction would cause some minor and temporary air quality degradation in the vicinity of the reservoir. However, state air pollution rules require construction projects to use reasonable precautions to prevent fugitive dust emissions. After construction is completed, normal residential activities, such as using wood stoves, fireplaces, and gas-powered grounds-keeping equipment and increased traffic would contribute somewhat to deterioration in local air quality but would have little or no impact on regional air quality.

Under Alternative A, any proposed industrial/commercial facilities would be reviewed on a case-by-case basis. No facilities are anticipated that would be inconsistent with meeting air quality standards and PSD regulations. In the event that a fossil-fuel power plant or equivalent facility would be developed on the land designated as “Steam Plant Study,” it would have to be designed and operated to comply with PSD requirements. Therefore, local or regional air quality would not be significantly deteriorated as defined by regulations.

Under Alternative B, no land is allocated to Industrial/Commercial Development (Zone 5). Alternative B does not propose a steam plant site, as forecast in Alternative A, which eliminates a potential source of air emissions. Also, this alternative proposes to allocate 85 percent of the total acreage into Zones 3 and 4. This would result in the majority of land being left in a woodland state that would contribute to enhanced air quality. The TVA technical review process concluded the Norris Dam Reservation Tactical Plan will have an insignificant impact on air quality.

Alternative A has the potential for greater air quality impacts than Alternative B because industrial and/or commercial development is possible. Alternative B, which would effectively preclude future industrial/commercial development on the TVA-controlled land, would definitely be more favorable for air quality.

3.13 Cumulative Impacts

Under Alternative B, the preferred alternative, 85 percent of the TVA public land acreage would be allocated to either Zone 3, Sensitive Resource Management or Zone 4, Natural Resource Conservation uses which would generally be less impacting than the current Forecast System on the surrounding environment. Under this alternative only 14 percent could be subject to more intensive development. Moreover, no TVA public land is allocated for industrial or commercial (i.e., business) use and only limited new commercial recreation development is anticipated. Future private water use facilities, public works, and TVA public land use proposals would be reviewed for compliance with applicable environmental laws and regulations.

Virtually all sensitive plant and animal communities, wetland habitats, and visually significant areas have been allocated to Zone 3, Sensitive Resource Management (17.3 percent of the TVA public land), where development would be unlikely. Management in Zone 3 would focus upon protection and enhancement of ecological function and would provide a high level of protection for the integrity of the significant natural features contained within them. Management in Zone 4 would focus upon management of natural resources to enhance the quality of outdoor recreational uses, such as hiking, hunting, and wildlife observation. These, as well as some Zone 3 land, are also the focus of TVA's resource management unit planning efforts. Because of careful planning associated with natural resource and public use management, sensitive resources would not be directly or indirectly adversely affected within Zone 4. Where appropriate (e.g., control of invasive exotic species and use of controlled burning) management would be implemented to enhance habitats for rare plants. A resource inventory for threatened and endangered species, wetlands, and cultural resources was conducted along shoreline where TVA would consider permits for water use facilities and residential shoreline alterations. The results were used to categorize the residential shoreline. Depending on the sensitivity of archaeological, wetland, and rare plant and/or animal species resources, the shoreline reaches were placed in either the Residential Protection or Shoreline Mitigation categories. This shoreline categorization system is designed to improve the protection of sensitive resources.

Watershed health can be defined as the ability to support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to those of natural habitats within a region. Alternative B would provide a better opportunity to protect water quality by identifying Sensitive Resource Management or Natural Resource Conservation (Zones 3 and 4, respectively) as the designated use on some parcels now having more general designations. Any of the proposed uses of Zone 3 or 4 land would allow for protection of water quality either due to less development or ensured use of management practices to minimize negative impacts.

Allocation of other parcels for future developed recreation activities or other public access/use areas, would allow TVA control over development to minimize adverse impacts. Thus, Alternative B would contribute to protecting and enhancing the health of the Clinch-Powell Watershed.

Adoption of Alternative B would have little overall potential for negative effects on rare plants and present opportunities for management and enhancement. Future land uses anticipated on sensitive and resource conservation parcels coupled with minimal development on other parcels, would afford rare plants and animals additional protection, so no direct or indirect impacts are anticipated. Cumulative effects would also be unlikely because less land would likely be used to accommodate development and; therefore, such use would not cause or contribute a local or regional negative trend.

Other than relatively small-scale timber harvests from private nonindustrial forestland in the Norris Reservoir watershed, TVA is unaware of any other major demands for forest resources in this general area. However, the continuing industrial, commercial, and residential development in the area will impact these terrestrial habitats. Because of its conservation emphasis, implementation of Alternative B would neither cause nor contribute to adverse trends on forests and associated ecological communities, and affect a very small amount of forestland in the region. Therefore, TVA has determined that the incremental and cumulative effects of adoption of Alternative B, when added to the past, present, and reasonably foreseeable future actions, are regionally insignificant. Similarly, insignificant cumulative effects are expected on protected species; wetlands; water and air quality; aquatic communities; socioeconomic; prime or other important farmland; and recreation, visual, and historic resources. Additionally, no long-term effects on regional biodiversity are anticipated from implementation of Alternative B.

3.14 Unavoidable Adverse Effects

Because of the requirement that site-specific environmental reviews will be conducted prior to implementation, there are currently few, if any, adverse environmental effects which cannot be avoided should Alternative B be implemented. However, regional development trends, such as residential shoreline development, will continue to result in losses of aquatic and terrestrial habitat. These losses would occur anyway and are not related to implementation of the Plan.

3.15 Irreversible and Irretrievable Commitments of Resources

Irretrievable use of nonrenewable resources (i.e., fuel, energy, and some construction materials) could occur under Alternatives A and B due to residential shoreline development as well as some types of recreational development. The residential development would result in region-wide population increase. This means that the same development could occur somewhere else in the region. Therefore, use of most (if not all) of these resources could occur somewhere else in the region to provide the same residential development services regardless of the alternative chosen.

As shoreline is converted to residential and recreational use, the land is essentially permanently changed and not available for agricultural, forestry, wildlife habitat, natural area, and some recreation uses in the foreseeable future. This is an irreversible commitment of land which would occur under all alternatives; over the long term, it would likely be greater in magnitude under Alternative A.

3.16 Energy Requirements and Conservation Potential

Energy is used by machines for fuel to maintain grassy areas on the dam reservation and by the operation of the hydroelectric plant located at Norris Dam. There are no short-term energy uses required for the dam reservation as it is already established.

Energy is also used by machines to maintain areas set aside for natural resource conservation. Although these activities are not likely to have much influence on regional energy use demands either, there would be some short-term energy use for fuel to conduct prescribed natural resource conservation activities such as mowing, timber management, controlled burning, disking, planting of small grain crops, etc. Alternative B would have a greater requirement for this type of energy use, since it contains the largest amount of acreage allocated for natural resource conservation.

A greater amount of TVA public land is allocated to a Sensitive Resource Management Zone in Alternative B. Some areas set aside for protection of archeological sites could potentially be maintained by mowing, light disking, or controlled burning. There would be some short-term energy use of fuel for machines to conduct these types of activities. The level of these activities is considered minimal.

3.17 Relationship of Short-term and Long-term Productivity

Commitments of the shoreline to residential access, commercial, industrial, and some types of recreational development are essentially long-term decisions that would decrease the productivity of land for agricultural, forest, wildlife, and natural area management. Long-term productivity decreases would likely be greatest under Alternative A. As described in earlier sections, the types of changes that occur with residential development would result in a decline in the habitat quality for some terrestrial species and increase the habitat for others. Many of the water-related impacts of shoreline development could be minimized by the use of appropriate controls on erosion, added nutrients, and pesticide input.

Increased development could occur under all alternative and result in population increase along the shoreline. There is a potential for small, long-term, socioeconomic productivity benefits from new jobs and income that would be the case, as long as the desirable features that prompted their move to the shoreline were maintained or enhanced.

3.18 Commitments

1. All land-disturbing activities shall be conducted in accordance with BMP's as defined by Section 208 of the Clean Water Act and implementing regulations to control erosion and sedimentation. Forest management activities will be conducted in accordance with practices prescribed for forestry (TVA, 1994). Timber harvests will be less than 20 acres in size. Visual and water quality enhancement buffers, between 50-feet and 100-feet wide, will be provided to screen timber harvest areas from public thoroughfares and shorelines and to minimize the potential for sediments or other nonpoint source pollutants to enter Norris Reservoir.
2. TVA will comply with its implementation procedures of any action would potentially affect wetlands or floodplains in accordance with Executive Order No. 11990 (Protection of Wetlands) to minimize adverse effects on wetlands and protect their natural and beneficial values.
3. Any development proposed in the 100-year floodplain will be subject to prior review and approval by TVA and the requirements of Executive Order No. 11988 (Floodplain Management) to ensure effects on floodplain values are minimized. Any facilities or structures subject to flood damage will be flood-proofed or located above the 500-year flood elevation.
4. TVA will take necessary steps to ensure compliance with regulatory requirements of the NHPA and ARPA. Through consultation with the SHPO, it was determined that 60 sites were potentially eligible for inclusion on the NRHP. In addition, one archaeological site will be further investigated to determine eligibility status

Historic resources surveys will be conducted prior to initiation of any soil-disturbing activity, including installation of additional wildlife openings, timber harvest, road construction, and parking areas. Consistent with a TVA/Tennessee SHPO Programmatic Agreement, a report on the survey findings will be submitted to the SHPO for review and comment.

5. Similar to the Davis Creek and Fullerton Bend Plans, TVA will prepare additional natural resource management unit plans and environmental assessments for some of its land allocated to Zones 3 and 4. With stakeholder inputs, these plans will enable TVA to determine the appropriate level of resource management and outline a schedule of activities, as well as assess the effects of these activities on this land. Work on these areas will be implemented consistent with provisions of the Presidential Executive Orders 13112 (Invasive Species) and 13186 (Migratory Birds).
6. Beech Island, Comby Ridge, Hemlock Bluff, Monks Corner, River Bluff, Norris Dam Cave, Stiners Woods, and Norris Song Bird Trail will all keep their designations as TVA Natural Areas for the life of this Plan. TVA will expand Monks Corner Small Wild Area by 25 acres. Nine new Habitat Protection Areas will be designated because of the presence of rare species or other sensitive resources.

7. Parcels allocated to Zone 7 will be managed in accordance with TVA's SMP in regard to vegetation management plans, shoreline buffers, access corridors, and other applicable provisions.
8. Controlled burns will be conducted in accordance with Tennessee open burning regulations.
9. BMP's for agriculture, including maintenance of vegetative buffers, will be included in agricultural licenses.